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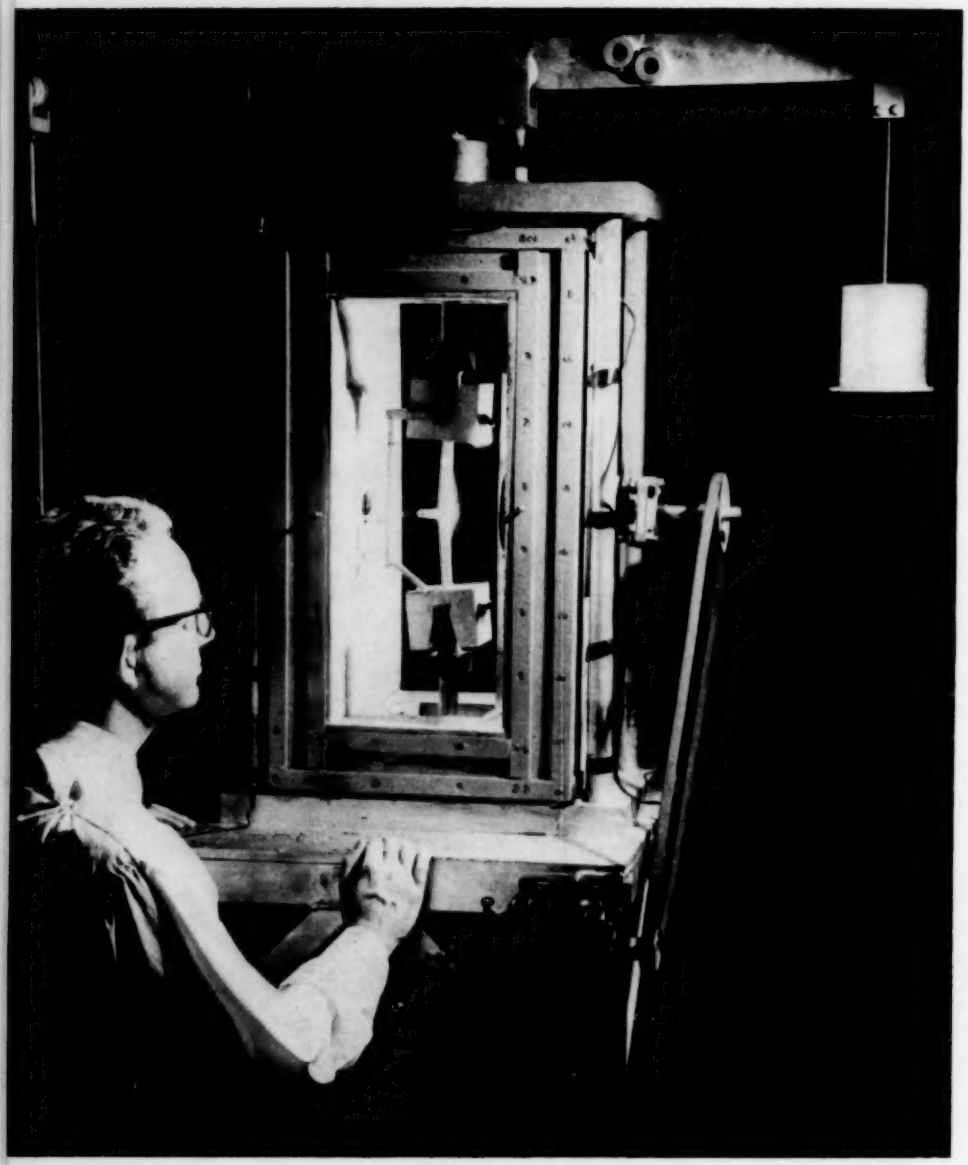
Battelle Technical Review

IN THIS ISSUE: Power Plants for Outer Space

DETERMINING COLUMN STRENGTH AT ELEVATED TEMPERATURES



Knowing the strength of structural elements under compression at elevated temperatures is important to designers of missiles, aircraft, and other structures. In the past, it has not been possible to predetermine the properties of a column with a continuously changing configuration due to creep. Research by Battelle metallurgist Robert L. Carlson and his colleagues, however, has led to the development of an analytical method for estimating the properties of columns at various temperatures.

In a study for the Air Force's Aeronautical Research Laboratory, a method was evolved for providing designers with information they need about the compressive strength of such structural members. The analysis—based upon the short-time stress-strain properties of materials—can specify the conditions necessary to maintain the stiffness required in a column to retain its usefulness.

The metallurgist checks the results of his analyses in the equipment shown here. Specimen columns, first subjected to compressive loads at 325 F are then "examined" by applying sudden load increases after various periods of time. The properties of the column at the time of the "examination" are deduced from the data obtained. Carlson is shown with a buckled column which has just been "examined."

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Abstracts of articles and papers in a wide variety of technological fields from more than 1350 journals published throughout the world. Abstract selection largely reflects primary areas of Battelle research.

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Engineering: A Career of Opportunity

Whenever and wherever a technological adavnce has taken place in our civilization, engineers have had a key role in bringing it to pass. And in each successive era, engineers have moved with the times. The great advances in scientific knowledge during recent decades have found them prepared for the opportunity to turn revolutionary discoveries to the uses of society. The conversion of atomic energy from theory to a great source of energy is a reality. Instrumented rockets and massive radiotelescopes extend man's senses, enabling him to probe the farther reaches of the universe. Currently, members of the profession are studying methods of making feasible still newer systems of energy conversion and are extending our communications network via satellites. In the case of a space rocket or superhighway, the engineer's contribution is obvious to all. But more of their contributions (like the submerged part of an iceberg) are not always apparent to the casual observer.

The character of the profession itself is undergoing significant change. The engineer has been viewed historically as the intermediary who converts scientific discoveries to practical, workable form. This conception of the profession is inadequate today. The present-day engineer is frequently at the forefront of scientific advance, and there is a growing fusion of interest and activity of the engineer and scientist. The instruments upon which scientists must depend for their data, unique materials they must have fo. their experiments, and novel processes necessary to their studies are some of the contributions of engineers. Conversely, engineering considerations are generating demands for new scientific concepts, theories, and data.

As Sir George Thompson points out, the engineer has a special role in science. As science becomes more abstract, the scientist needs the engineer as a touchstone to reality. Quoting him: "When conclusions deduced from precise experiments by mathematical theory lead to detailed predictions from which working machines can be designed . . . then indeed one knows that one lives in a universe which is rational and that one has found the key to one of its rooms."

All of these responsibilities and accomplishments and many more, in an ever-widening circle, have been opportunities for the growing number of engineers to benefit their fellow men. And the opportunities and challenges continue to multiply. The challenge of the great population expansion, which presses on the world today, intensifies the demand for creativity in, and dedication to, the solution of problems upon which the continuance of our civilization may depend.

Thus, as science advances, the dependence of society upon the engineering profession increases, and the responsibilities and opportunities of engineers multiply. It must have been with thoughts such as these in mind that the planners of Engineer's Week (February 19-25) this year adopted the theme, "Engineering: A Career of Opportunity".

Edward E. Slowter, Vice President, Battelle Memorial Institute

Power Plants for Outer Space

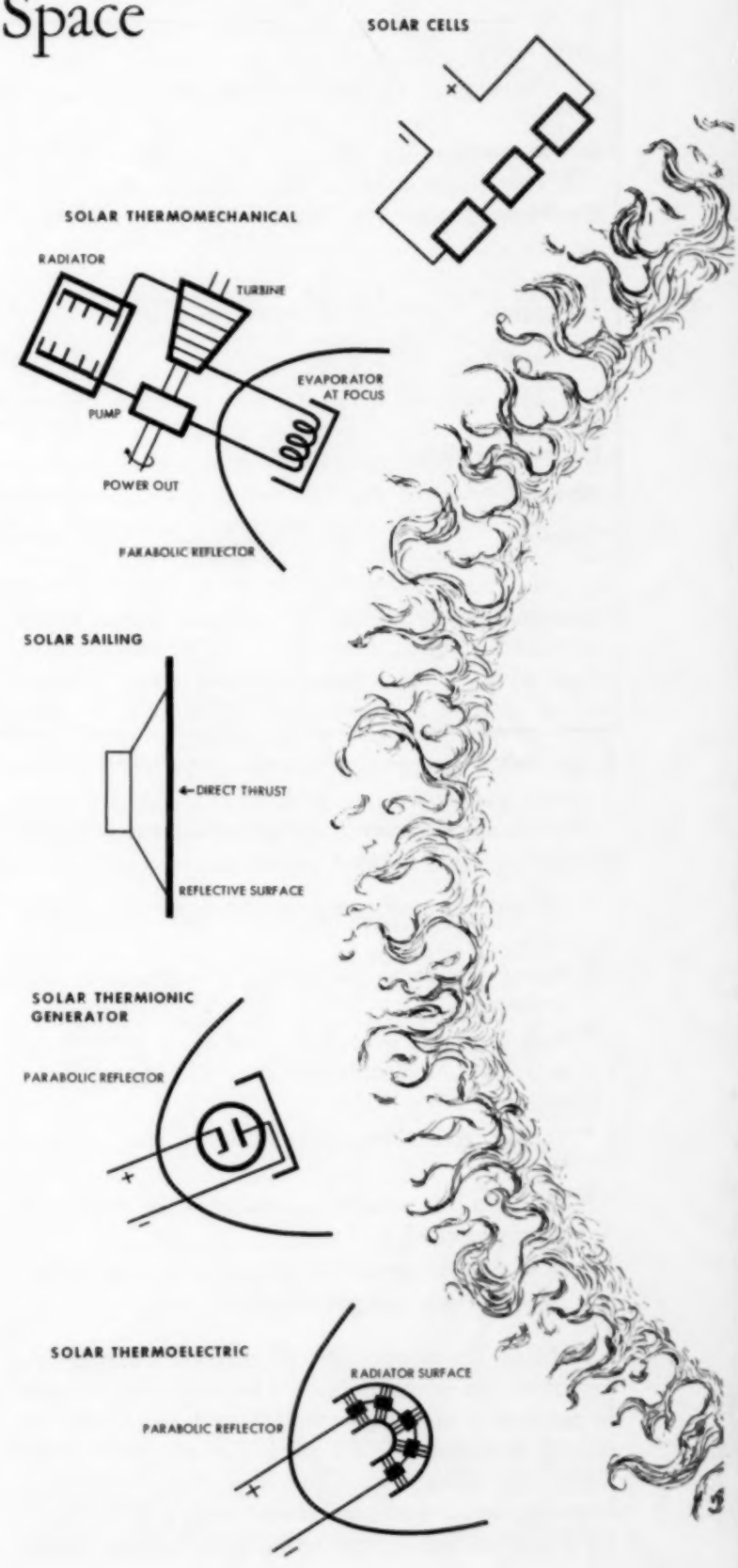
Weight factors impose stringent limitations upon energy conversion systems in space vehicles. Systems now available or being developed, and their potentialities, are discussed here.

by JOHN M. ALLEN

MAN'S SUCCESSFUL CONQUEST of space requires more than just launching passive instruments and equipment with large rockets; it requires that diverse operations be carried out in space. These operations, whether they be manned or unmanned, require the expenditure of energy and, in some proposed missions, expenditure of large amounts of energy. These energy demands impose new and serious design problems; there are stringent limitations on the weight that can be carried on any mission, whether it be related to a supply of energy or to the means of converting energy into the desired form. These energy demands for space vehicles have stimulated an intensive review and re-evaluation of all energy sources and energy conversion systems. We need to know the energy form and energy conversion system best suited for each class of space mission.

Of the many possible energy sources for space vehicles, three appear to offer promise and are being developed. These are: chemical energy, from the thermochemical process of burning a fuel or from the electrochemical process of discharging a battery; atomic energy, from nuclear reactors or radioisotopes; and solar energy, collected from the sun's electromagnetic radiations.

Figure 2, shows the energy-conversion systems being developed or modified for use in space vehicles. The energy form supplied to the conversion system is shown on the left, together with an approximation of the theoretical maximum energy that can be stored per pound in each form. The principal demands for energy in a space vehicle are either for direct thrust or for electric power which, in turn, can be used for thrust, communications, life-support system, or other demands. These forms of energy as utilized, together with important intermediate forms, are noted along the top of the table, so that each conversion system can be properly oriented as to the form of energy supply and delivery.



1. *Methods of utilizing solar energy in space vehicles. Three methods provide direct conversion of solar to electrical energy; one, solar to mechanical energy; and one converts solar energy directly to thrust.*

FORM OF ENERGY SOURCE	ULTIMATE STORAGE POTENTIAL BTU/LB	FORM OF ENERGY DELIVERED BY SYSTEM				
		THRUST	ELECTRIC POWER	MECHANICAL	CHEMICAL	THERMAL
Basic Forms						
SOLAR ELECTRO-MAGNETIC	Nil	Solar Sail	Photovoltaic cell	.....	Fuel cell regeneration	Solar collector
ELECTROCHEMICAL CELLS	200	.....	Batteries Fuel cells	.....	.....	.....
EXPENDABLE FUELS	7×10^3	Combustion rocket motor	Fuel cells	Combustion-driven engine turbine, etc.		Combustion source
NUCLEAR FISSION AND FUSION	5×10^{10}	Direct expulsion of products	Direct conversion	.....	.....	Reactor
RADIOISOTOPES	3×10^5	.....	Thermoelectric couple Atomic battery Thermionic diode	.....	Fuel cell regeneration	Isotope heat chamber
Intermediate Forms						
CHEMICAL	7×10^3	.....	Fuel cell	.....	.....	Combustion
THERMAL	10^3	Light gas rockets	Thermoelectric couple Thermionic diode	Engine or turbine	Fuel cell regeneration	.....
MECHANICAL	20	Adiabatic expansion in nozzle	Rotary generator	.....	.....	.....
ELECTRIC	200	Plasma rocket Ion propulsion	Rectifier, alternator, transformer	Motor	Electrolysis	Arc discharge

2. *Principal energy-conversion techniques contemplated for space vehicles.*

The choice of preferred energy conversion system is affected by many factors, including:

- Ultimate form of energy required, electric, thrust, heat
- Power demands, maximum, average, and continuous
- Path followed by vehicle, including natural environment encountered, take-off accelerations, eclipses.
- Vehicle limitations, spin, shielding, size, orientation
- Duration of mission including total time and energy needed
- State of development of utilization system including efficiency, weight reliability, etc.

Although the complex interrelations of these factors preclude a universal preference for one energy source or conversion system, several general trends are becoming apparent. Weight more than any other single factor determines whether one or another combination of energy source and conversion system will be chosen for a mission, and weight will depend on the mission requirements, especially power demand and the duration of this demand. The point at which different integrated systems become equally attractive changes with the continuing development of each system. Correlations of preferred power system with mission demands, as given below, must therefore be accepted as inexact and fluid.

Chemical energy is best for missions of less than one day. When the total energy requirement is one kilowatt-hour or less, primary batteries appear preferable on a weight basis, whereas a combustion system seems better suited for energy in excess of a kilowatt-hour. Fuel cells may ultimately supersede the more conventional combustion-driven turboelectric systems, though fuel-cell technology is not yet sufficiently advanced to make them competitive with the combustion systems.

For energy demands lasting more than one day, nuclear or solar energy appear to be required. Solar cells are best for power levels below one kilowatt; they can be used at low energy levels without a weight penalty and require no auxiliary equipment for conversion to electric energy. Solar energy also appears to be preferred for power levels up to about 25 kilowatts. At such levels, energy is obtained by concentrating the

radiant energy with mirrors. The heat is then used to operate a thermomechanical device, such as a closed-cycle prime mover operating an electric generator, or a thermoelectric or thermionic converter. For power levels above 25 kilowatts, a nuclear reactor supplying heat to thermomechanical devices probably will give the lowest weight per kilowatt, assuming minimum shielding and no refueling during a mission.

The high reliability required from energy sources for very long missions—10 years or more—probably rules out any dynamic devices and raises doubts about other types. A nuclear reactor would certainly have to be refueled several times. This leaves only solar energy systems: and they may not be dependable for such lengthy periods.

Figure 3 summarizes the above correlation of preferred energy source and conversion system for each combination of mission power and duration, as the situation appears at this time.

Solar Energy Utilization

The external source of energy available to a space vehicle beyond the atmosphere is radiant energy from the sun. This source has several inherent characteristics which limit its use. The energy flux decreases as the distance from the sun is increased; the energy is not available while the vehicle is in a planetary shadow, and the flux is available at such a low level that large receiver areas must be utilized for power systems of appreciable size. The need to expand collector area linearly with increasing power requirements is a serious disadvantage of solar energy. Weight-to-power capacity ratio for other energy sources (e.g., nuclear reactors) tends to decline.

Solar Cells

Solar cells are now being used exclusively for long-duration power sources in satellites and space probes. These small photovoltaic devices have shown their reliability and can be assembled in banks to provide moderate power. Silicon cells have been used almost exclusively to date. Other semiconductor materials could be used, however, and would be preferred if operating temperatures were changed appreciably. Over-all conversion efficiencies of 12 per cent are available with only slight improvements probable in the near future.

Individual cells less than an inch in size, are used now, and these must be mounted on a suitable support and connected into electric circuits. When low power rates are required, the cells can be mounted directly on the vehicle shell. With a sufficient number of cells facing each direction, vehicle orientation is not required. For demands of 100 watts and above, additional structures are required to support the cells, and control to orient all cells continuously toward the sun is justified. When in continuous direct sunlight, weight of the cells themselves can be kept to about 25 lb/kw, weight of support structures must be added.

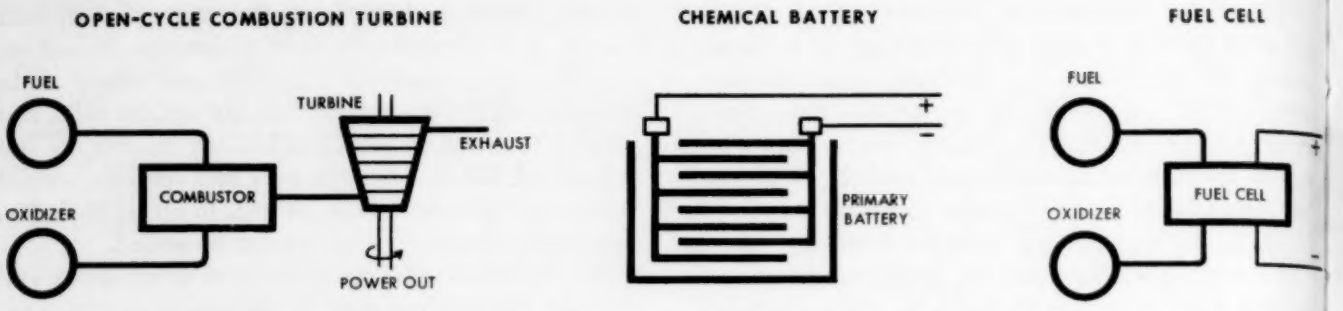
Solar cells must be protected from temperature and particle impacts inherent in the space environment. The power output is temperature sensitive and falls off sharply with increases in temperature. Unfortunately, because of their optical properties, silicon cells operate at excessive temperatures under radiation equilibrium in direct sunlight near the earth. The simple addition of a thin glass window over each cell lowers the equilibrium temperature to an acceptable value. The presence of both high-energy atomic particles and micrometeorites must also be considered. Few accurate data exist about the effects upon the cells of atomic particles, such as are encountered in the Van Allen belts. Yet the possibility exists that high-energy particles may displace the controlled impurity atoms in the crystal lattice, thus adversely affecting the power potential of the cell. Therefore, a protective transparent coating, adding appreciable weight, may be required if prolonged operation in a radiation belt is anticipated. Micrometeorites would destroy any thin-surface layer on the cells in time, but probably would produce little effect below the surface. While accurate estimates of micrometeorite damage are not available, it would be insignificant in lifetimes of up to a year.

Direct Solar Conversion to Thrust

The direct conversion of solar radiation to thrust has been proposed as a practical means of space propul-

POWER LEVEL	DURATION OF DEMAND		
	LESS THAN DAY	DAY TO SEVERAL MONTHS	SEVERAL YEARS
0 - 1 kw	Primary batteries	Solar cells	Solar cells
1 - 25 kw	Combustion-driven thermo-mechanical	Solar-thermo-mechanical	Solar thermionic or thermoelectric
Above 25 kw	Combustion-driven thermo-mechanical	Reactor-thermo-mechanical	Solar thermionic or thermoelectric

3. *Power level and duration of demand. The energy conversion system which is preferred depends on both the power level demanded and the duration of this demand. As design and fabrication capabilities are improved, preferences will change.*



4. *Chemical energy systems for space vehicles. These systems are based upon processes already in use or under development for other applications.*

sion. The radiation pressure exerted on a normal reflecting surface at the earth's distance from the sun is about one dyne per square meter. This equals one pound of thrust for 100 acres of sail area. To use this force, lightweight, highly reflective sheet materials weighing less than 10 pounds per acre are required. Punctures in these films by small meteorites is not a serious problem. However, vaporization and degradation of the reflective surface by atomic-sized particles of solar origin or micrometeorites would seriously limit the effectiveness of such sails.

Indirect Solar Conversion

Indirect methods of utilizing solar energy generally involve conversion of the radiant energy to thermal energy by heating a working fluid. This fluid is then used in some power-conversion cycle. As such cycles are limited to the Carnot-cycle efficiency, a high upper temperature is desired, thus indicating use of a reflector-type mirror to concentrate the radiation onto a small collector. Due to the finite size of the sun, an exact point focus is not possible. A near perfect reflector at the earth's distance from the sun provides a heat flux of about 15,000,000 Btu/ft²hr at the focus. Since this obviously is a higher heat flux than is necessary for efficient heat absorption, there is some design latitude in mirror geometry and reflectivity and receiver temperature.

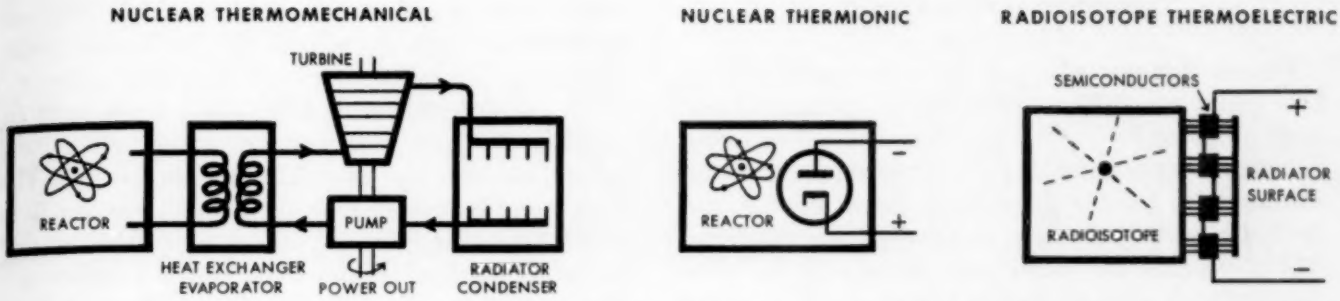
Inflated solar concentrators or reflectors of metalized plastic films have been proposed. Such reflectors, of course, must have a reasonable life when unprotected in space. The reflective metal surface itself will tend to protect the film from ultraviolet radiation damage. The film reflectors can be made to operate at a very low temperature by having a high-emissivity surface on the rear. In this manner evaporation of both the volatile components of the plastic and the reflective coating can be minimized. While the punctures by larger micrometeorites may not be serious if some means other than gas pressure is provided for retention of shape, consideration must be given to degradation of the reflective surface from abrasion by particles.

The use of a rigid mirror presents serious problems in structural design, particularly for the larger power systems. The rigid surfaces, supporting beams, and struts in any collector larger than a few feet in diameter would require assembly beyond the Earth's atmosphere to avoid excessive aerodynamic loads during launch. The probable weight of 1 to 2 lb per ft² of rigid reflector makes these structures attractive on a weight basis only if a highly accurate focus can be maintained. The temperature-fluctuation problem associated with shadow transits of a satellite may result in severe stress concentrations in the collector and limit the accuracy of focus after entering the sunlight.

Two integrated solar-powered thermomechanical systems are currently being developed. Both use reflectors to concentrate the heat and use liquid metals as the working fluid with a closed Rankine cycle. Over-all efficiencies of approximately 25 per cent are expected with a weight of about 60 pounds per kilowatt for a 15 kilowatt system.

Nuclear Energy Utilization

The fund of fundamental and engineering know-how on the design and operation of nuclear reactors is extremely large; yet no reactor has been built and operated in a space vehicle. Several specialized conditions are immediately apparent in the space application: weight must be kept to a minimum, shielding may be unnecessary, large amounts of fuel burnup may be required without refueling, and maintenance during operation must be minimized or entirely eliminated. Unshielded reactors weighing 300 pounds or less which will deliver 5,000 kw for 100 days without attention, have been discussed. They are, however, beyond the present state of the art of reactor technology. The SNAP program is currently developing a 70-kw system which is expected to weigh 3,000 pounds, or less, thus producing continuous power at a specific weight of less than 45 pounds per kilowatt.



5. Nuclear energy systems. Reactors in space vehicles are promising for high power levels for limited periods. Systems utilizing radiactive isotopes may have longer life, but relatively lower power levels.

In the interest of weight minimization, the core of the reactor need not be enclosed by a radiation shield. Instead, the crew, if any, would be located behind a shielding plate, and thus be in its "shadow". Most of the equipment and structural components would thus be exposed to the radiations from the reactor. The radiation dosage would, of course, depend on the relative position and type of reactor used; and for the design of any component, the dosage at the appropriate location must be known in advance to assure the choice of materials which can withstand that dosage.

Radioactive isotopes can be used as a source of power, either as heat or for electrical generation directly in an atomic battery. The advantages are long life, which depends on the isotope used, and high energy content per pound of isotope material. The principal characteristics are continuous power release, and predictable decreases in the release rate associated with the half life of the isotope used. Materials being developed into sources include these: strontium 90, krypton 85, tritium, cerium 144 and polonium 210. Efficiencies of utilization of the isotope degradation energy into useful electrical energy have been as high as 20 per cent. Small power systems using isotope heat sources with theromelectric converters are being developed which might compete with other systems for low power demands over extended periods.

Chemical Energy Utilization

Chemical energy systems have the advantage that they are readily available with a wide variety of operating performances, are relatively reliable and inexpensive, and can be packaged in a wide range of power capacities. Systems utilizing fuel combustion include such types as open-cycle gas turbines in which fuel and oxidizer are burned in a combustor and discharged through the turbine. Lightweight gas turbines using fuel combustion as the energy source can supply energy at any reasonable rate which may be required, even up to 10,000 kw. The principal limitation inherent in these combustion systems is the weight of the fuels and oxidizer which must be carried. Each application would require special design to assure minimum weight for that specific mission. The science of combustion-driven power units is so advanced, however, that reliable equipment and fairly accurate predictions of its performance can usually be made.

Since the science of fuel-cell development is relatively new and not well established, its competitive position for space applications cannot be adequately evaluated. Nevertheless, they are of great interest. It appears that cells capable of providing a kilowatt of power—weighing about one pound per kwhr, including fuel—are a possibility.

Chemical-voltaic batteries can provide primary energy or accumulate electrical energy for use at a later time with great dependability. Good primary batteries can provide energy at a weight of about 10 pounds per kwh. Once practical reliable fuel cells are available for space applications, chemical-voltaic batteries will be used only where the total energy demand is too small to justify the fuel-handling equipment and fuel-cell mechanism.

John Allen has participated in diverse studies on energy systems and other problems. His first research at Battelle was concerned with the improved utilization of fuel in steam locomotives. He has taken part in the development and analysis of a number of thermodynamic systems including the application of solar energy in ground-base installations. He contributed to the choice and evaluation of materials for rocket nozzles and other very high temperature applications, investigated feasible systems for solving specialized wind-tunnel problems, and aided in the development of a system for the thermal processing of petroleum products. The study of fluid-flow problems in nuclear reactors has also engaged his attention. Before joining Battelle, Allen was associated with the National Advisory Committee for Aeronautics (now NASA).

Thermomechanical Cycles

Various thermomechanical systems, consisting of a heat engine coupled to a rotary electric generator have been proposed for electric power generation in space vehicles. Heat engines that are applicable and under consideration include those using the Rankine vapor cycle, the Stirling gas cycle, and the Brayton gas cycle. These systems are considered principally in conjunction with solar or nuclear power.

Two significant requirements associated with the application of these power systems to space vehicles should be noted—the need for heat storage and unusual working fluids.

Two factors associated with the use of power plants in space make incorporation of a heat-storage bed into the energy-conversion cycle expedient. These are the eclipse phenomenon and the use of radiation as the only heat-disposal system available on space vehicles. In solar-driven satellite power systems, the energy source is unavailable to the systems for nearly half of the total operating time. Storing electricity in batteries or the storage of heat at the high-temperature end of the cycle are possible methods for assuring continuous power. Several analyses have shown that energy storage as heat can be accomplished with a lower system weight than the storage of electric energy in a battery. That the conversion equipment can be smaller if it operates continuously also contributes to the preference for energy storage in the form of high-temperature heat. Storage of heat at both the high-temperature and at the low-temperature ends of the cycle has advantages in some situations, particularly when short bursts of energy release are required which would exceed the rate capacity of both the heat source (solar collector or nuclear reactor) and heat sink (radiator).

WORKING FLUIDS	MELTING TEMPERATURE, F	BOILING TEMPERATURE AT ONE ATMOSPHERE F	PROBABLE MAXIMUM CYCLE TEMPERATURE F	PROBABLE MAXIMUM RADIATOR TEMPERATURE, F
Helium			1500	1000
Hydrogen			1500	1000
Aluminum Bromide	207	505	1500	1000
Mercury	−38	675	1400	900
Sulfur	246	832	1200	800
Rubidium	100	1260	2200	1500
Lithium	1367	2440	2500	1700
Potassium	144	1420	2400	1700
Sodium	207	1638	2300	1600

6. *Working fluids for thermomechanical cycles.*

Several materials with high latent heats must be considered as heat-storage media, including beryllium silicon, lithium, and especially lithium hydride. The high latent heat at melting (of about 1,000 Btu/lb at 1,256 F) makes lithium hydride so outstanding that adjusting the temperature levels of the complete system to permit use of the material is justified. Heat storage, using LiH, is being incorporated into both solar-driven thermomechanical power systems now being developed in this country.

All waste heat from closed-cycle thermomechanical systems in space vehicles must be disposed of through radiation. The required radiation area is, of course, inversely proportional to the fourth power of the radiation temperature. This limitation becomes particularly significant in nuclear- and solar-power thermomechanical systems larger than a few kilowatts, where the vehicle shell can no longer satisfy the waste heat rejection requirements. System analyses have shown that the radiator is a large fraction of total mass of the larger power units, and therefore, radiator size predominates in determining temperatures in the system. For a given maximum cycle temperature, the area of the radiator is minimized when the absolute radiator temperature is about three quarters of the absolute temperature of the heat source. The over-all minimization of weight for a given power capacity, therefore, results in a radiator temperature close to three quarters of the maximum cycle temperature, a corresponding over-all thermal efficiency of about 25 per cent, and operation at the highest temperature level possible.

Figure 6 lists the materials being considered as working fluids for space power systems and the cycle temperatures being considered for each material. It is noteworthy that the higher temperature applications all involve liquid metals as working fluids.

The chemical compatibility of these working fluids with the possible containing materials is the principal determinant in choosing the upper temperature in the cycle. This compatibility also determines the minimum weight required for a given power capacity.

The development of improved power systems for space applications is truly a demanding task calling for scientific accomplishments of a pioneering nature in many technical fields. The results of this diverse program should significantly improve our nation's capability in the exploration and utilization of space, with its associated political implications, and should also develop technical capabilities and know-how which are useful in many other fields of activity.

Programming for Teaching Machines

Effective programming of teaching materials is a major factor in the ultimate success of teaching machines. The author presents approaches to programming and problems to be considered.

by JOHN S. ABMA

TEACHING MACHINES ARE AROUSING unprecedented interest and excitement on the educational scene. At a recent national convention of the American Psychological Association, papers and symposia on teaching machines attracted overflow audiences. At the same convention ten different self-instructional devices or teaching machines were offered for sale. Articles about teaching machines are appearing in both the professional and popular literature at a growing rate.

Two factors contribute to this interest: (1) the pressing need to educate more young people with too few teachers and (2) the possibility of dramatically improving the quality of instruction. The need factor is obvious. Classrooms at all levels from grade school through college are crowded; teachers are handling classes entirely too large for effective instruction; and our industrial society requires more education for more of our citizens. Even if teaching machines could perform only as well as traditional methods of instruction, their use might be expedient. But it appears that teaching machines can actually provide improved quality of instruction. This does not mean that teaching machines should or could replace human instructors. Instead, the machines could be valuable tools in the educational system, to be used by instructors for specific purposes.

At present, most of an instructor's time is spent presenting routine skills and facts over and over again. The instructor usually presents these facts to large classes and cannot be assured that every student is learning, or even paying attention to the material. Teaching machines can relieve the instructor of repetitious drill and leave him free to do the things a human instructor does best. These include: leading group discussions; developing social skills, values, and ideals; counselling individual students where needed; pointing out new implications or applications of course material; discussing the general goals of education; improving the teaching machines used by the students; and, in general, providing inspiration to guide the students' interest and growth. Human instructors will never be replaced in these roles by teaching machines. Instructors will, on the contrary, be able to function more effectively in these roles only when teaching machines or other means are used for the routine tasks that now pre-empt so much of an instructor's time.

Teaching machines are more comparable to individual tutors than they are to classroom lecturers or group leaders because each student works alone with his machine. In this way many advantages of tutoring can be provided. The term "tutor" is actually part of the brand name of several machines now available.

The following are important characteristics of teaching machines:

1. Using teaching machines, each student may proceed at the rate which is best for him. No one need be left behind, nor are the brighter students in a class held back.

2. Completion of a teaching-machine course represents a known achievement, since each step must be understood before the student can proceed to the next one.

3. The student is "tested" continuously, and the correctness of his answers is made known to him immediately. This feedback enables a learner to judge his performance accurately and to correct it where necessary. A permanent record of his errors is usually obtained.

4. Attention to the task is extremely high when a student works with a teaching machine. His

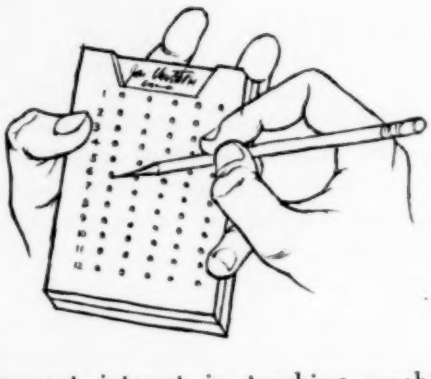
mind does not "wander" because he is actively engaged in the learning process.

While agreement on the value of teaching machines is general, there is considerable disagreement over what are the best teaching machines for given situations. Teaching machines range in complexity all the way from simple cardboard masks that are moved by hand over printed instructional sheets to complex electromechanical devices. Some of the more complex machines present both motion pictures and associated "stills" which may contain multiple-choice questions or displays similar to what might be found on a printed page, i.e., printed sentences, paragraphs, questions, diagrams, or pictures. As part of the learning process, the student pushes buttons on the machine in answer to questions which appear; his performance is automatically recorded.

Except for the automatic recording of responses and the showing of motion pictures, essentially the same instruction is available in simple book form with no mechanical aspects. These are not ordinary books, of course. Inside, we find the same "stills" that were exhibited on a screen and the same multiple-choice questions. Instead of pushing a button to indicate his answer to a question, however, the student selects an answer from a printed set of alternatives. Each alternative has a page number printed alongside it. As he selects an answer, the student also finds the page number he turns to next. On that page he discovers whether he was correct and receives the next step in the course. If his answer were wrong, the student would find corrective instructions on the page to which he turned.

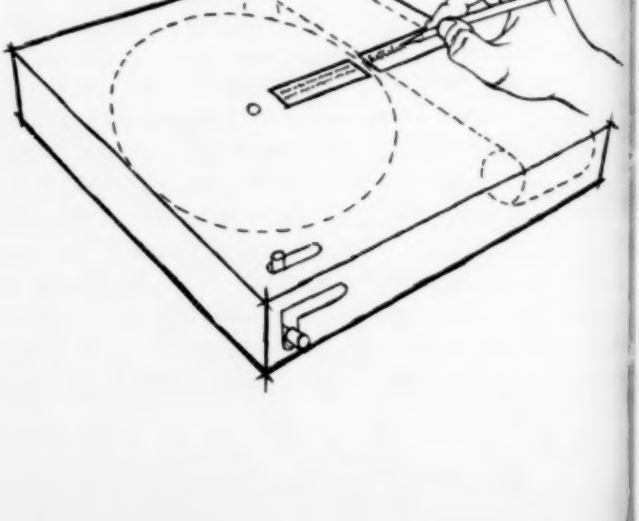
The earliest teaching machines on record are those of S. L. Pressey, Professor of Psychology (Emeritus), The Ohio State University. Dr. Pressey wished to streamline the testing procedures in his college classes by having students score their own objective tests. He was also aware that immediate knowledge of results on the tests would be beneficial to the learning process, especially for rote learning. Using a variety of push-button and card-punch machines. Pressey and his students found, in a series of experiments dating from 1926 to 1950, that students who tested themselves by machine did better than students tested in regular classes. The machines were not used independently of other instructional media, such as textbooks and lectures, but were used primarily for drill and testing of course content.

Pressey's card-punch machine represented a very simple approach to immediate feedback devices. Multiple-choice questions were presented on a separate mimeographed sheet. To select an answer, the student would insert a pencil or stylus into a numbered spot on a four-by-eight inch board—small enough to be held in the hand. Only if a correct answer were chosen would the stylus go through the board. Wrong answers were recorded by the pressure-mark left when a student attempted to punch through an incorrect location.



The present interest in teaching machines was stimulated in a large part by a 1958 article in *Science*. In that article Professor B. F. Skinner of Harvard University described procedures for "shaping" verbal understanding. Shaping refers to the acquisition of "difficult" material or knowledge by reinforcing the "easier" steps leading toward it. Technically, the word "difficult" is equivalent to low-probability-of-occurrence, and "easy" responses are those with high-probability-of-occurrence. The probability of occurrence of any response can be increased by "reinforcement" following the response. In education, knowledge of being right is reinforcing. By reinforcing those aspects of an easy concept which have something in common with a difficult concept, it is possible to raise the probability of occurrence of the difficult concept. To learn concepts of increasing difficulty is, of course, important in the educative process.

Teaching machines developed by Skinner and his followers provide for written responses on the part of the learner. His disk machine is illustrated here.



Selected items are printed on the circumference of a cardboard disk, which is mostly hidden by the machine's cover. Windows in the cover permit the student to see only one item at a time and to write out in longhand his response to questions presented. The student then compares his answer with the correct one that appears when the disk is rotated to the next item.

With the variety of outward appearances, mechanical arrangements, and methods of operation exhibited by teaching machines, identifying them becomes a problem. Teaching machines are better defined by several unique functions they perform for the user than by their appearance.

Teaching machines may be identified by three essential functions:

1. Presenting the course content in small units or items. Usually an item is a short, printed statement that appears in a window or on a screen of a teaching machine.

2. Providing for some action or response on the part of the student after every item. The response may be written out by the student in a second window or opening in the machine, or the student may select a response from four or five alternatives printed near the item—a multiple choice. The student makes multiple-choice selections by pushing a button on the machine or punching an answer card with a stylus.

3. Providing the student with immediate knowledge of results, or feedback, regarding the accuracy of each answer. In the case of a written answer, the student can compare his answer to a printed one that comes into view with the next item. A push-button machine can prevent the next step from appearing until the right answer is given, or a light can glow for correct answers only.

The questions of feedback and the kind of response to be required of the student are of great interest and importance. Both questions are related to current learning theories as well as to training practices and will no doubt continue to attract research. But challenging questions also arise in the first teaching machine function listed above, that of *presenting a topic in small steps*. This is the problem of programming. The questions raised here are peculiar to teaching machine development, and few answers are provided by past research.

Programming

Preparing the course for teaching machine presentation is *programming*. The resulting list of statements and questions is the *program* of a teaching machine. The machine itself does no teaching; it merely provides the occasion for interaction between a student and a program. A teaching machine without a program would be comparable to a book with blank pages or a slide projector with no slides.

Certain basic questions arise during programming. Significant among them are the following:

Exactly what is to be taught? If the course is high school algebra, for example, what equations, functions, and operations will be included? What "real-life" examples will be given, if any?

In what order will items be presented to the student? Can earlier items be used to lead up to more advanced concepts? Should the more general principles be given at the outset, or only after many heuristic examples?

How difficult should the question associated with each item be? Should most students be able to answer all questions correctly? Or should the questions be more "challenging"?

How long should each item be? One sentence? A paragraph? A page? How can the topic be reworded into small items?

How much review of earlier items will be provided in later parts of the program?

These are important issues both for programming and for educational practice, generally. They suggest controversies that have troubled educators for centuries. A program printed and distributed for use in teaching machines exposes to public scrutiny every instructional intuition and decision made in the process of teaching a given subject. Little wonder that agreement is rare on matters of programming. Let us examine a few programming techniques.

To illustrate some of the techniques available we will program a topic by different methods. The topic, "making change with coins", might conceivably be part of a beginning course in arithmetic for young children. We offer only a few of the first frames or items in what would probably be a lengthy program of perhaps 100-250 frames.

Self-testing

Pressey's teaching machines usually required the study of a textbook assignment or lecture notes, followed by self-testing of the material studied. Since this technique includes so much of the conventional and familiar teaching methods, it will serve as our first example.

Here is the beginning of the textbook assignment:

Coins are used to make change, and to make change we must have coins. We can make change for any amount of money if we have enough coins. Examples of coins are pennies, nickels, dimes, quarters, and half-dollars. To make change for one nickel we give five pennies—that is, five pennies are change for one nickel, etc.

After studying this assignment in its entirety—it might be a whole chapter of ten or more pages—the student would attempt to answer questions which would be presented one at a time in his teaching machine. The student would punch a key on the machine corresponding to the answer of his choice. An example is shown below.

Frame	Question	Alternatives	Punch Key
1	There are some amounts of money for which we cannot make change.	True	1
		False	2
2	Change for one nickel is (choose correct answer)	Impossible with only 3 coins	1
		Made with nickels and dimes	2
		Made with 3 pennies	3
		An example of where no coins are needed	4
3	Coins are (choose correct answer)	Half-dollars	1
		Used to make change	2
		Dollars	3
		Not needed for small change	4
		Five pennies	5
4	If we have five pennies (choose incorrect answer)	We have change	1
		We have a nickel	2
		We might give them in change for a nickel	3
		We have 3 coins	4

Example of program for self-testing method.

Any errors in selecting answers would be revealed to the student and accumulated by a counter on the machine. The student might repeat the test until he answered all questions correctly. He might discover he needed review of certain parts of the assignment. The test questions are primarily diagnostic in purpose. They reveal areas of weakness to the student and can suggest the need for remedial work. If wrong answers are given, the student may return to the assignment, where most of the learning is assumed to occur.

Intrinsic Programming

The second major programming technique to be illustrated was developed by Norman A. Crowder and is called "intrinsic programming". Like some of the earlier methods, intrinsic programming uses multiple-choice questions. Unlike earlier methods, the textbook reading assignments are broken down into small sections, one page or even one paragraph in length, and a question is asked after each section. The new concept of "branching" is introduced which enables students to take different paths through the material to be learned.

Each answer directs the student to the next section, or, if he has made an error, to a page where he receives corrective instruction. In the following example, the course content illustrated is identical to that used in the first example. Only the programming method has been changed.

Coins are used to make change and to make change we must have coins. We can make change for any amount of money if we have enough coins. Examples of coins are pennies, nickels, dimes, quarters, and half-dollars.

Now, choose the answer you think is correct and turn to the page indicated.

Coins are:

	Turn to Page
1. Pennies and quarters	16
2. Worth less than half-dollars	42
3. Used to make change	23

If the student should select page 16, he would find the following:

Your answer: Coins are pennies and quarters.

Pennies and quarters are just two kinds of coins, so your answer is not the best one. There is something we can say about all coins.

Now, go back to page 1 and try again.

If the student turned to page 42:

Your answer: Coins are worth less than half-dollars.

Not so good. Half-dollars are themselves examples of coins so they cannot be worth less than themselves. Perhaps you were thinking of the fact that other coins are worth less than half-dollars. Reread page 1 carefully, then choose another answer.

The correct answer would bring the student to page 23.

Your answer: Coins are used to make change.

You are correct.

The student then goes on to the next item:

Now let's see how change is made. To make change for one nickel we give five pennies—that is—five pennies are change for one nickel.

So, after we gave change for a nickel we would have in our possession which of the following?

Turn to Page

1. A nickel 17
2. Five more pennies 3
3. I don't get this at all 56

If he turns to page 17 he will find:

Your answer: A nickel

You are correct.

Good. From here we go on to consider ..... etc. .....

On page 3 he will read:

Your answer: Five more pennies.

No. (Here additional reading would be provided, and the student returned to page 23).

He will discover the following on page 56:

Your answer: I don't get this at all.

(Here, additional reading would be provided, possibly with another example. The student would be returned to page 23)

Crowder's programming is called intrinsic programming because the sequence of items studied by the student is determined by the student's interaction with the program. To some extent, the material "programs itself" for each student. The multiple-choice question after each section is primarily diagnostic in function, and is used to channel the student to the next appropriate page.

Intrinsic programming is especially useful where the task to be learned is of a problem-solving nature, such as radio repair or other electronic trouble-shooting. In these tasks, there may be no single correct path to a goal, but each learner might use different paths with equivalent results.

Control of the course of study is probably improved over textbook reading because of the more frequent diagnostic testing and branching. The learning process itself is still assumed to occur as a result of reading the one-page sections. Thus, intrinsic programming may be considered a very useful refinement of conventional teaching methods, bringing with it some of the advantages of "tutor instruction" through the technique of branching.

Shaping

In the programming methods originated by B. F. Skinner, there is no connected text or paragraph to study. Instead, the student carries on a "written conversation" with the program by making many responses or answering many questions as he goes through the material. Rather than studying or rereading a text, the student "learns his way" through the course material.

1. We can make change for any amount of money if we have enough coins (copy underlined words).

   _____ _____, _____

   Answer: Make change, coins

2. Coins are used to _____ _____.
   (Fill in blanks)

   Answer: make change

3. To make change, we must have _____.
   (Fill in blank)

   Answer: coins

4. Examples of coins are p_nn_s, n_ _k_ _s, d_m_s, and q_ _rt_rs.

   Answer: pennies, nickels, dimes, and quarters.

5. To _____ _____ for one nickel, we give five pennies.

   Answer: make change

6. _____ pennies are change for _____ nickel.

   Answer: five, one

Skinner-type programming for teaching machine.

Our example of Skinner-type programming, shown above, will use the same course content, except for a convenient reversal in the order of the first two sentences.

Since there is no provision for branching, the program is called a straight-line program. Each student proceeds in the same way through all of the items or frames. However, the program is self pacing, inasmuch as each student may proceed at his own rate.

The example of Skinner programming appears to be shorter than the other techniques; but generally this type of programming is longer. One reason for long programs by this technique is the importance of maintaining a low error rate. Ideally, all of the questions should be answered correctly by all of the students, to facilitate learning. This is in contrast to the other techniques which include challenging questions that many students will miss. The emphasis on low error rates is not calculated to pamper the student or make life easy for him by protecting him from error. Rather, the intent is to influence the learning process directly—not merely register correct performance after it occurs.

In Skinner-type programs, the purpose is to shape verbal or "thinking" behavior. The reinforcement provided is the knowledge of being right. Once the course of instruction is completed, the reinforcing habits of the community are relied upon to maintain the shaped behavior.

When we analyze Skinner-type programming, we are really analyzing shaping techniques applied to verbal behavior. The following is a list of some of the techniques illustrated in our example of "making change".

1. *Prompt.* A prompt is the appearance of the desired response in the program item itself. Usually, the student merely copies a prompted response. The underlined words "make change" and "coins" are prompts in Item 1. These may also be referred to as "formal prompts".

2. *Cues* are illustrated in Item 4. Correct responses are suggested by giving parts of the desired words. These may also be described as "thematic prompts".

3. *Fading.* If we had followed Item 4 with an identical item, but with the cues eliminated, we would have *faded* the cues.

4. *Intra-item cues and prompts* are illustrated by Items 1 and 4. The cue or prompt is contained within the item.

5. *Inter-item cues and prompts* are illustrated by item pairs 1, 2, and 5, 6. The correct response for Item 2 is suggested by part of the response to Item 1. Two words are called for in each case, as illustrated by the blanks provided. The correct responses to Item 6 are suggested by the wording of Item 5.

These detailed techniques are only a sample of the methods that might be used to increase the probability of correct response by the student. In general, almost any kind of tutorial ingenuity may find expression in the program. Branching is possible in a Skinner-type program, but is not considered necessary. The few errors made by students using the program would not justify the effort and expense of providing separate learning paths. Furthermore, it is felt that branching might result in a student's missing some important steps.

John Abma's first concern upon joining Battelle was the solution of human engineering problems in the development of a reading machine for the blind. He shared responsibilities in the selection of the aural code, in designing the equipment for easiest handling by the blind user, in the formulation of a training program for the use of the reader, and the analysis of users' experience with the equipment. More recently he has participated in a further study of auditory codes suitable for print reading by electronic readers. In other research he aided in a study of visual coding of business forms for easy handling and contributed to a study on human problem solving. Earlier, while studying for his M.A. degree in experimental psychology, Abma taught at Michigan State University.

Teaching Machines for Psychomotor Skills

Examples of psychomotor skills are typewriting, riding a bicycle, playing a musical instrument, and shooting a rifle. In these kinds of skills, accuracy of muscular (motor) movement is more important than talking about or "understanding" the topic. Any verbal explanations that may be used in instruction for psychomotor skills are expected to drop out as proficiency increases and the performance becomes automatic. Teaching machines can make an important contribution in the teaching of psychomotor skills.

One existing device gives automated instruction to key-punch operators, who prepare data cards for electronic computers. The machine presents lines of letters or numbers in a display panel, and the learner presses the appropriate key or keys in response to the display. If the student delays in pressing a key, a light appears to prompt the correct response. The rate and quality of responding determines which exercise the machine will display next and how rapidly the student must respond to each letter. Thus, improvement in performance results in faster pacing of the stimulus material up to a pre-determined goal level. If errors are made, or the response rate lowered, the machine reacts by allowing more time for each item, giving more prompts, and perhaps presenting an easier exercise line.

In general, teaching machines for psychomotor skills are complex both electronically and mechanically. The responses to be learned must be executed on the teaching machine itself, and discrepancies between present and desired performance levels must be measured by the machine. Aside from these greater problems of instrumentation, however, the programming variables are in every important respect similar to those for verbal learning. Regardless of how intelligently a motor-skill teaching machine may function, human decisions are still needed regarding:

1. Error rates desired.
2. Kind and amount of feedback.
3. Sequence of exercises.
4. Prompting and cueing techniques.
5. Standards defining completion of training.

The Future

Where and *when* to use teaching machines are questions that will always involve a balancing of

economic and training values. Whenever teaching machines can be used both to increase training effectiveness and reduce cost, the choice is clear. In other instances, the cost of appropriate teaching machines might exceed their contribution to broader objectives.

The development and refinement of programs is a major expense involved in any new application of teaching machines for verbal or conceptual topics. For psychomotor skills, the cost of the teaching machine itself is a large investment. There seems little doubt, however, that teaching machines could be developed to handle almost any kind of training job for which their use is desired.

A few possibilities in addition to the usual schoolroom subjects are:

- Industrial training in skills that combine "mental" and "motor" abilities, as for telephone operators.
- Musical training. Learning to play an instrument would be facilitated by the shaping of relevant muscular coordination, control, and timing. Special training or practice instruments could be provided in addition to the musical instrument being studied.
- Vigilance training. Radar operators, for example, could be taught to pay better attention to a viewing screen if artificial targets were presented at carefully selected times.
- Sports. The directions of a golf or bowling instructor could be implemented by machines that would provide accurate feedback for correct and incorrect movements.

These possibilities should not suggest that psychologists or any other group have solved all the mysteries of learning. This is no more likely than that chemists, physicists, or mathematicians will find themselves without new work to do. Every advance in science seems to result in additional challenges.

The development of teaching machines marks the beginning of an interaction between learning psychologists and educators that holds tremendous promise for both professional groups. Psychologists will gain in their understanding of the learning process and educators will gain in the effectiveness with which they can prepare their students for the demands and opportunities of society.

The most profound significance of teaching machines may well lie in the improved morale of the students who will use them at all educational levels. Teaching machines have demonstrated that continual frustration is neither a desirable nor necessary feature of learning. Education can be an experience in which failure and the threat of failure are supplanted by the satisfaction of acquiring desired skills and knowledge.

SCIENCE'S IMPACT ON FOREIGN POLICY

"Science and technology are constantly creating new conditions with which foreign policy must deal. Out of technology has come the revolution in warfare imposed by nuclear weapons and ballistic missile delivery systems. Out of it have come the political, social, and economic changes induced by the growing ease and speed of communication and transportation, leaving no nation isolated. The 'revolution of rising expectations' is in large part engendered by the power of technology to improve health and living standards and the growing awareness of underdeveloped countries of this benign power. It is engendered, too, by the recent demonstrations that technology is mobile, that the sophisticated technology of the West under favorable conditions can be quickly copied by countries of less sophistication.

"Finally there is the acceleration in change itself generated by science, a factor which has introduced a wholly new order of dynamics into foreign affairs . . .".

James R. Killian, Jr., Chairman, Corporation of The Massachusetts Institute of Technology.

GEORGE H. SCHIPPEREIT

Despite the greater availability of materials of many types, metals are still pre-eminent, in the view of metallurgist George H. Schippereit. "When we consider the heavy new demands being placed upon metals by the space-age and nuclear needs of our civilization, to name only two, we may fairly say that metals are more important than ever. To meet the growing needs, metallurgists are developing specialized compositions and are making numerous metals available that were only laboratory curiosities a few years ago. These advances, and many more to come, are the result of the growing store of knowledge and of the creation of new metallurgical theories that make possible great leaps forward in the usefulness of metals."

When George joined Battelle in 1948, his first research was associated with the development of techniques for producing zirconium fuel elements for the *Nautilus*. Solution of the problem called for pioneering work in the forging of zirconium. Later he turned his efforts to the study of titanium production processes and participated in developing methods for melting and casting the metal. Working out methods of extruding titanium and titanium sponge were other problems to which he turned his attention. George participated, also, in the development of titanium personnel armor. Later, he was associated with the study of a method for the magnesium reduction of columbium pentachloride.

Another important development to which he contributed was the cold crucible furnace. By utilizing induction heating of metal in a water-cooled crucible, the furnace provides an effective method for melting reactive metals such as titanium. In other investigations, George has studied problems of arc melting of refractory metals.

George received both his bachelor's and master's degrees in metallurgical engineering from the Polytechnical Institute of Brooklyn. During the latter part of this period he held a research fellowship. On graduation he joined Arma Division of American Bosch Arma Corporation as a metallurgist.

Now technical advisor, responsible for research liaison between Battelle and industry, George has served as chairman of the Ohio Valley Section of the American Institute of Mining, Metallurgical, and Petroleum Engineers. He holds membership, also, in The Electrochemical Society. A number of important publications in the field of titanium metallurgy bear his name as author or co-author.

With four sons and two daughters, George and his wife Mary have a busy homelife. Eventually George hopes to pass off the big lawn-mowing job and some other tasks to the boys. That would leave more time for golf and bowling.

NOTES from BATTELLE

✱ INVESTMENT IN RESEARCH

Capital investment, once associated only with bricks and mortar—plants, equipment, and inventories—now goes far beyond that narrower definition. Today, on the basis of the economists' definition of the word, research and advertising must be considered as part of the investment picture. This was the view expressed by Martin R. Gainsbrugh, Chief Economist of the National Industrial Conference Board, in a presentation before the Battelle staff.

"To the economist, investment is an expenditure from current or past earnings which, it is hoped, will yield a return in the future," Gainsbrugh explained. "Investment may be associated with income, service, or intangibles. In recent years, many have come to look upon research and development as investment since the funds thus spent are expected to throw off income at some later period. Even more recently has come the extension of the investment process in demand creation and product acceptance, known as the advertising process.

"The label 'growth company' is frequently applied now to an enterprise characterized by a high and rising research outlay per dollar of sales rather than, as in the past, by high or rising investment in plant and equipment. Going beyond this, the research talents of an enterprise—intangible and difficult of quantitative evaluation as they may be—receive top consideration by investment organizations in appraising the true net worth of many enterprises.

"The motives of investment in research and development by industry," the economist declared, "have already been divided into two aspects in one of our studies—cutting costs to improve competitive position and product innovation. A third aspect that is beginning to emerge is some degree of recognition of the value of 'pure' research and of technical information that contributes to the common store of knowledge."

✱ TANTALUM FOR HIGH TEMPERATURES

With its high melting point (2996 C) and retention of plasticity down through -196 C, tantalum offers the greatest temperature range of structural usefulness of any metal. Though already in general use in various electronic applications, the metal's most immediate potentialities appear to lie in the use of its alloys in high-temperature environments. As a material of construction, tantalum's future seems to lie in the temperature region just below that served by tungsten and above that served by the lower melting alloys of molybdenum and columbium.

According to Daniel J. Maykuth, Battelle metallurgist, tantalum shows extensive solubility for many high-temperature strengtheners including tungsten, columbium, molybdenum, vanadium, hafnium, and zirconium. Moreover, it has good tolerance for impurities such as carbon and oxygen. These facts make tantalum alloys less susceptible to contamination in processing than some other metals. The metal's disadvantages are its high density, costliness, and limited oxidation resistance at high temperatures. Tantalum alloys require protective coatings in oxidizing environments.

Several tantalum-base alloys with excellent high-temperature potentialities have been developed. Thus, a tantalum-30 columbium-5 vanadium alloy is especially attractive because of its low density as compared with tantalum. At temperatures from 1200 C to about 1400 C tantalum alloys are expected to have strength-to-weight ratios at least as great as columbium alloys; and they should have greater strengths at higher temperatures. Indeed, because of the metal's high melting point, tantalum alloys may find use in the 1400 C to 2200 C range where only tungsten now serves as a metallic material of construction.

✱ STABILIZING POLYAMIDES

Improving the stability of organic polymers is a continuing concern of chemists. The effects on polymer stability of such chemical reactions as hydrolysis, cross-linking, and photoinitiated oxidation are generally recognized; and the use of antioxidants to prevent degradation is, of course, widely practiced. Much less is known, however, about the effects of physical changes upon polymers, largely the result of the crystalline character of the materials.

In a recent study at Battelle, reported by Michael M.

Epstein and Charles W. Hamilton, Institute chemists investigated how crystallization is related to degradation and sought means to control physically-induced deterioration. From their own and published studies, they knew that crystallization can be affected by controlling such processing conditions as quenching, annealing, and externally applied orientation as by drawing.

The study involved experiments with a stabilized copolyamide and an experimental composition, Nylon 66/610/pip-10. The most beneficial treatment for the former was discovered to be partial orientation by heating. Annealing at 200 C considerably enhanced its stability, but resulted in stiffening of the filament. The experimental nylon was improved most by partial orientation by drawing with quenching in ice water during extrusion. Though the treatments had detrimental effects upon the original properties of both filaments, after 8 days of aging the properties of the treated filaments were considerably superior to those of the untreated filaments.

The chemists concluded that a high degree of internal ordering is important for resistance to changes in mechanical properties during aging. Since molecular orientation both enhances the tendency to crystallization and to more uniform, more perfect crystals, embrittlement from crystalline imperfections would tend to be less severe in drawn filaments. Moreover, since drawing would also tend to rupture large spherulites, embrittlement would be further reduced.

A major conclusion from the study was that physical treatment alone is not sufficient to heat stabilize nylon effectively. Since amorphous material is susceptible to thermally induced oxidation, and since quenching and drawing prevent the disappearance of such material, antioxidants are obviously needed. Improvement of polyamide stability, therefore, calls for combining proper physical treatment with the use of additives.

* SCIENTISTS, ENGINEERS IN INDUSTRY

The number of scientists and engineers employed by U. S. business firms in January, 1960 totaled more than 815,000. This figure represented an increase of nearly 7 per cent over the 764,000 employed a year earlier. By way of comparison, the growth during the year 1958 had been 5 per cent. These are the highlight preliminary figures of a survey conducted for the National Science Foundation by the Bureau of Labor Statistics. Publication of the final report is planned for early 1961 by NSF.

The Foundation reveals that about 80 per cent of the total number covered by the survey were engineers. Of the remaining 20 per cent, almost one-half were chemists. Other physical scientists—physicists, mathematicians, metallurgists, and geologists—made up an additional 35 per cent of the scientists employed.

The number of engineers employed by industrial firms increased about 40,000 (6.6 per cent) during 1959. Employment of scientists rose more than 10,000 (7 per cent). About 40 per cent of engineers and scientists were engaged in research and development activities, a significant increase over the previous year.

The largest employers of scientists and engineers were the electrical equipment and aircraft and parts industries with about 100,000 each in January, 1960. Chemicals and allied products, machinery, and petroleum products each employed more than 50,000 each.

* IMPROVED INCINERATOR

Smoke, unburned vapors, and fly ash from backyard incinerators—major contributors to smog in many metropolitan areas—have been virtually eliminated in an improved type of gas-fired household incinerator described by Battelle engineers at the Fall Conference of the Building Research Institute in Washington. Factors involved in the design of the incinerator were the subject of a technical paper prepared by Richard B. Engdahl and Glen M. Hein.

The improved incinerator was developed jointly by the American Gas Association Laboratories and Battelle, under the sponsorship of the American Gas Association.

Key features of the new design include: 1) a high-heat, gas-fired afterburner with separate air supply which operates at about 1500 F to completely oxidize smoke and odors, 2) controlled supply of combustion air to regulate rate of burning and minimize loss of fly ash, and 3) sufficient input of heat from gas flame to completely burn all combustible refuse, including wet garbage.

The American Gas Association has offered the results of the research program to incinerator manufacturers, encouraging them to incorporate features of the improved design in their products in order to meet municipal air-pollution requirements. Many household incinerators now in production have been redesigned to include these improvements and, as a result, have been accepted for use in such cities as Chicago, Detroit, Cincinnati, and Columbus.

Writings by STAFF Members

Determination and Identification of Impurities in Silicon From Low-Temperature Hall Data. Low-temperature measurements of the Hall effect have been used to determine donor and acceptor concentrations and in some cases to identify the major impurity in Si. A simple apparatus for making these measurements with liquid helium is described. Typical results are presented and correlated with lifetime data at room temperature. Interpretation of the Hall coefficient measurements is discusssed, and a simplified analysis of the case of the two types of donor impurity is suggested. ***R. T. Bate, L. R. Weingarten, and D. J. Shombert.*** *Electrochemical Society, Journal*, v. 107, Nov. 1960, p. 908-911.

Theoretical Study on Homotopy Theory and Duality for Modules and Spaces. Homotopy groups of two variables and their duality properties are studied both in the algebraic and in the topological context. On the algebraic side, the theory of these groups and their exact sequences is built up in a most general framework. The results are then applied to special cases and interrelated with known algebraic concepts, primarily for modules over a ring. On the topological side, algebraic topology is shown to be obtainable from the groups, their exact sequences, and the related concepts. The new concepts and results suggested by the duality are investigated. ***Battelle Memorial Institute—Geneva.*** PB 147 255; *Final and Annual Technical Report No. 1*, February 29, 1960, 14 pp. AD-234 398. (LC mi $2.40, ph $3.30.)

Stress-Corrosion Cracking of Ti-5Al-2.5Sn. A large number of unexplained cracks were encountered in the fabrication of complex assemblies of Ti-5Al-2.5Sn. These were not the usual stress cracks, but consisted of regular families of cracks in certain areas. This cracking sometimes occurred during welding but was particularly prevalent after heat treatment. Efforts to repair-weld the areas usually resulted in further propagation of the cracks. Laboratory investigation and a survey of technical literature indicated that the cracking was similar to stress-corrosion cracking due to chlorides. Source of halides was trichloroethylene, used in standard degreasing practice; when new cleaning methods were substituted problem of stress-corrosion cracking was eliminated. ***Hiram Brown.*** Defense Metals Information Center, *DMIC Memorandum 60*, PB 161 210; Aug. 4, 1960. 11 pp. (OTS $0.50).

Characterization of Inclusions in Dingot Uranium. The nonmetallic inclusions in both as-reduced and fabricated dingot U were studied for comparison with those in ingot U. Special attention was paid to the hydride for the purpose of determining the amount and distribution in the various types of U. The types and distribution of other inclusions were also studied. It was found that the dingot U was of a higher quality than ingot U and was comparable to as-reduced derby U on the basis of over-all inclusion count. The H content in dingot U, however, was found to be appreciably higher than in either ingot or derby U. ***Donald M. Cheney and Ronald F. Dickerson.*** U. S. Atomic Energy Commission, *BMI-1158*, Jan. 11, 1957, 22 pp. (OTS $0.35).

Progress Relating to Civilian Applications During May, 1957. Presents some results of work done at Battelle on development of nuclear fuel elements, processing of feed materials, design of components, and characterization and evaluation of nuclear metals and other materials. ***Russell W. Dayton and Clyde R. Tipton, Jr.,*** U. S. Atomic Energy Commission, *BMI-1189*, June, 1957, 64 pp. (OTS $0.50).

Hazards Summary Report for the VMR Critical-Assembly Experiments. Critical experiments are described for the Variable Moderator Reactor. The site, laboratory, and the critical assembly, including control and safety mechanisms, are described in detail. Special characteristics of the assembly pertinent to safety have been calculated. The nuclear energy released and the average and maximum fuel temperatures resulting from step reactivity increases up to 2 per cent $\Delta k/k$ are presented in graphical form for two cases. In the first case, fuel-temperature effects are considered to be the only shutdown mechanism; in the second radiolytic gas is considered to contribute to shutdown, in addition to fuel-temperature effects. ***Richard A. Egen, William S. Hogan, David A. Dingee, and Joel W. Chastain.*** U. S. Atomic Energy Commission, *BMI-1445*, June 1960, 72 pp. (OTS $2.00).

References to Research on High-Emissivity Surfaces. Review work of a number of projects which have been established to develop improved methods of measuring emissivity and to determine the emissivity of various materials at both high and low temperatures. ***J. W. Holladay.*** PB 161 207. Defense Metals Information Center, *DMIC Memorandum 57*, June 27, 1960, 8 pp. (OTS $0.50).

Investigation of Sinterable Powders and Properties of Berllia Ceramics. Information was developed on the effects of processing variables and microstructure on the fracture strength of ceramics made from sinterable oxide powders. The characteristic of high strength being associated with low porosities and small average crystal sizes was observed in ceramics of both MgO and BeO, but no quantitative correlation was found. Highest strengths were obtained when time and temperature of sintering were sufficient for densification above about 96% of theoretical, provided that the sintering time and temperature was insufficient to give crystal sizes larger than the smallest observed, 5-6 microns for BeO ceramics and 10 microns for MgO ceramics. ***James E. Johnson, A. J. Smalley, and Winston H. Duckworth.*** PB 161 891; Report for Feb. 15-Dec. 21, 1959, on Electrical and Electrical Materials, *WADD Technical Report 60-108*, Apr. 1960, 24 pp. (OTS $0.75).

Physical Properties of Some Nickel-Base Alloys. Compiles data on the physical properties of 33 representative Ni-base alloys to present under one cover the available data on physical properties and to point out those areas in which data are lacking. The report is divided into two main sections. The first is a tabulation of the chemical compositions, in which the alloys have been classified into six groups according to the major alloying elements: Ni-Cu, Ni-Si, Ni-Cr, Ni-Cr-Fe, Ni-Cr-Co, and Ni-Mo. The second section contains definitions of the terms used to describe the physical properties, the status of available data, and data sheets and graphs for each of the representative alloys. ***M. E. Langston and C. H. Lund.*** Defense Metals Information Center, *DMIC Report 129*, May 20, 1960, 146 pp. PB 151 086. (OTS $2.75).

How a Fuel Cell Operates. The author compares the fuel cell with the ordinary battery, discusses fuel cell efficiency, kinetics, and costs. He also explains briefly how several types work. A hydrogen-oxygen fuel cell, and ion-exchange membrane fuel cell, regenerative fuel cells-the redox and the converter are discussed. ***L. D. McGraw.*** *SAE Journal*, v. 68, Dec. 1960, p. 74-79.

HOW TO GET COPIES

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Properties of PbSe Prepared by Powder-Metallurgy Techniques. The application of powder-metallurgy techniques to the preparation of bulk specimens of lead selenide was studied; both the hot-press and the press-and-sinter methods were employed. Compacting pressure, sintering temperature, sintering time, and the particle size of the powder were treated as variables. Electrical and thermoelectric properties, densities, and microstructures of the specimens were studied. Sound specimens of near-theoretical density and with electrical and thermoelectric properties similar to those of the best of cast lead selenide were prepared successfully by the hot-press method. Electrical properties of specimens with densities in the range 90-98% of theoretical, which were prepared by both the hot-press and the press-and-sinter methods, did not change significantly as density varied in this range. ***J. F. Miller and R. C. Himes.*** *Electrochemical Society, Journal,* v. 107, Nov. 1960, p. 915-919.

Selected Short-Time Tensile and Creep Data Obtained Under Conditions of Rapid Heating. A graphical presentation of stress-versus-temperature curves of tensile strength, yield strength, and stress to produce 1% creep strain or rupture in designated times is presented. Data are given for 28 alloys of general interest. Includes a bibliography. ***Donald P. Moon and Ward F. Simmons.*** Defense Metals Information Center, *DMIC Report No.* 130, PB 151 088; June 17, 1960, 88 pp. (OTS $2.00).

Department of Defense Titanium Sheet-Rolling Program. Summarizes the progress made in the program from Jan. 1, 1959, through Dec. 1959. During this period, the production of the heat-treatable alloys has been completed by one producer and is nearing completion by the other two producers. Three new alloys have been added to the program, Ti-7Al-12Zr, Ti-8Al-1Mo-1V, and Ti-8Al-Zr-1(Cb+Ta). These are designed to be weldable alpha alloys with high creep strength. ***H. R. Ogden.*** Defense Metals Information Center, *DMIC Report No. 46H,* PB 151 087; June 1, 1960, 74 pp. (OTS $2.00).

Turning of High-Strength Steels in the Hardness Range of 330 to 560 Brinell. The proper selection of feeds, speeds, and depths of cut appropriate for recommended tool materials and designs are important for adequate tool life and metal removal rates. Carbide tool materials best suited for use include the C-6, C-7, and C-8 grades. Ceramic tools also can be used for turning high strength steels. One cutter design uses 5-degree negative rake angles, a 15-degree side cutting edge angle, and 5-degree relief angles. High-speed steel cutters appropriate for turning high-strength steels include the molybdenum type M-2, and cobalt grade, M-15. Tungsten high speed steel with 5 per cent cobalt (T-15) seems to give the best tool life. ***C. T. Olofson.*** Defense Metals Information Center, *DMIC Memorandum* 58, PB 161 208, July 15, 1960, 44 pp. (OTS $0.50).

Nucleic Acid Metabolism in HeLa S3 Cells After X-Ray-Induced Mitotic Delay. A depression in the percentage of cells in DNA synthesis accompanies resumption of mitosis, but is followed by a return to near-normal values, in the evolving giant cell population. As the number of cells in the population decreases, owing to abortive divisions, the percentage of cells in synthesis slowly decreases. One of the effects of irradiation appears to be a mixing of the cells in the S and G_2 phases of the population at the time of the irradiation, so that cells from both compartments are in the population of cells that begin dividing after mitotic delay. ***Robert B. Painter.*** *Radiation Research,* v. 13, no. 5, Nov. 1960, p. 726-736.

Development of Corrosion-Resistant Alloys for Use as Container Materials for Decladding Solutions or as Welding Alloys. Twenty-four experimental alloys were developed and evaluated as container materials or welding alloys for use with Sulfex and Niflex decladding solutions. Niflex solutions, which were more corrosive than Sulfex solutions to most of the experimental alloys, produced severe localized attack at weldments made on vacuum-melted Hastelloy F with the experimental alloys. However, several of the alloys, when self-welded, were not selectively attacked. Some of these showed a substantial improvement in resistance to the decladding solutions. The most promising alloys were based on either 45 w/o Ni-22 w/o Cr or 50 w/o Ni-25 w/o Cr, with at least 6 w/o Mo, and 1 w/o Ti, 0.6 w/o Mn, 0.4 w/o Si, 0.02 w/o C, and balance iron. The alloy most resistant to both solutions contained 6 w/o Mo and 1 w/o Cu in the 50 w/o Ni-25 w/o Cr base. ***Charles L. Peterson, David C. Brennen, Merritt E. Langston, A. M. Hall, and Walter K. Boyd.*** U. S. Atomic Energy Commission, *BMI-1459,* Aug. 7, 1960, 62 pp. (OTS $1.50).

Final Report on Studies of Turbulent Premixed Flames and Methods of Suppressing Combustion Oscillations. Summarizes the results obtained in the program "Research on Combustion of Liquid and Gaseous Fuels". The program consisted of two distinct phases, Phase I, covering "A Study of Methods of Acoustical Dampening in Rockets", and Phase II, covering "A Study of the Effect of Turbulence in the Flame Speed of Homogeneous Gas Mixtures". In the first phase, two methods of generating transverse oscillations in an axially symmetric combustor were investigated, (1) that of using a transducer and (2) that of using a small H-air burner. A transducer suitable for the investigation could not be found, so the effort was mainly devoted to the study of combustion oscillations generated by the burner. ***Abbott A. Putnam, Gail M. Clough, and Milton J. Kenworthy.*** U. S. Air Force, *WADC Technical Report* 56-853, Dec. 1956, Individually paged. (OTS $3.50).

Acoustical Systems Determine Oil Burner Pulsations and Their Amplitudes. Pulsations present in oil-fired heating units result from acoustical phenomena, even though the energy for driving the pulsations is derived from the combustion process. It is the acoustical system which determines the frequency, and to a large extent, the amplitude of the pulsations. Changes in furnace and burner variables which affect the combustion process also affect the acoustical system. The variables important to the generation of pulsations have been delineated; these are the furnace volume, the fuel-spray pattern, the air pattern, and the pattern of the recirculated hot-combustion products. The detailed mechanism of pulsation has been shown to involve two independent phenomena; an acoustic pressure oscillation and a period rate of heat release. ***C. F. Speich and A. A. Putnam.*** *American Society of Heating Refrigerating and Air-Conditioning Engineers Journal,* v. 2, No. 1960, p. 63-69.

Minutes of Conference on Hydrogen in Uranium Held at Battelle Memorial Institute, June 11, 1954. A discussion of methods of analysis for hydrogen in uranium; dehydogenating treatments; hydrogen pickup in processing; metallography; and effects of hydrogen on corrosion behavior and physical properties. ***C. R. Tipton, Jr.*** *BMI-X-126* July, 1954, 23 pp. (Mi $2.70, ph $2.80).

A Modified Tin-Flux Technique for Determination of Oxygen in Titanium. The standard Walter method of determination of O in Ti was reinvestigated and a modified tin-flux procedure was developed. The extraction of O_2 was carried out at 1950 C without the use of graphite chips or crucible lid, which were considered essential by early workers. Also, conditions for rapid degassing of the crucible assembly were established. ***Ch. Venkatewarlu and Manley W. Mallett.*** *Analytical Chemistry,* v. 32, Dec. 1960, p. 1888-1890.

Dispersion-Hardening in Binary Titanium-Copper Alloys. Dispersion-containing titanium-copper alloys were prepared having mean free paths varying from 1.0 to 9.7μ. Tensile studies at room temperature and at 1000 F showed that little or no strengthening occured when the mean free path exceeded 3μ. However, at lower values of mean free path appreciable strengthening was observed. A considerable amount of strengthening also resulted from copper in solid solution. ***D. N. Williams, R. A. Wood, H. R. Ogden, and R. I. Jaffee.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 787-791.

Molybdate Pigments: New Corrosion Inhibitors. A study was made of calcium and zinc molybdates to determine their corrosion inhibiting properties. In some instances these pigments, either alone or with a topcoat, exhibited anti-corrosion properties which equalled or exceeded those of red lead under the test conditions. Suggestions for possible uses of these materials are given. ***Helmuth O. Schoen and Benson G. Brand.*** *Official Digest,* v. 32, Nov. 1960, p. 1522-1543.

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ABSTRACTS

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

a

* **The Engineer's Role in Management.** Engineering must provide a stream of products on which profitable perpetuity of the firm may be based. In so doing, it must manage innovation, which is the process of filling the new product stream bed and maintaining a velocity of flow. Engineering must also learn to manage contribution, which is the major asset or capability of the people entrusted to engineering management. Finally, engineering must master lead time—the one irretrievable asset in its box of tools. ***Frank Walter.*** *Advanced Management*, v. 25, Oct. 1960, p. 13 + 3 pages.

b

* **Minimizing the Planning Gap.** Describes the long-range planning function as an integrated decision-making system and discusses its position in the organizational hierarchy. Particular attention is focused on the key problem of coordinating the efforts of specialized planning staffs and line management. Possible approaches to alleviate this planning gap are outlined. ***Fremont Kast and Jim Rosenzweig.*** *Advanced Management*, v. 25, Oct. 1960, p. 20-23.

c

How Industrial Chemical Research Organizes for Creative Drive. Recognizing the need for a more basic approach to research, a number of chemical companies are taking positive steps to do something about it. This article reports some of these activities. ***Gordon Weyermuller.*** *Chemical Processing*, v. 23, Nov. 1960, p. 43 + 3 pages.

d

Identifying Significant Research. Literature citation counting is evaluated as a means for identification of significant research. It concludes that analysis of literature citations is a useful measure of the significance of research. Analyses based on gross number of citations, net number of citations (in-house and self citations omitted), replicate citations, and ratio of citations to papers published give results which are in general agreement. ***J. H. Westbrook.*** *Science*, v. 132, Oct. 28, 1960, p. 1229-1234.

e

What Is Wrong With Industrial Research? Excerpted from a speech given at a meeting of the Synthetic Organic Chemical Manufacturers Association in New York. Defines fundamental rsearch as the search for understanding, while exploratory research is the search for discovery. Believes the research is bad not because of methods and techniques used, but because of pressures on men to proceed directly to a well-defined objective without achieving any understanding or even knowledge of the chemistry required to attain the objective. ***Herbert C. Brown.*** *Research/Development*, v. 11, Nov. 1960, p. 101 + 4 pages.

f

What the R/D Budget Covers. The problem of "What should the budget for the technical effort cover?", can be best handled by careful consideration of four aspects: A careful, detailed statement of objectives, a consideration of the technical effort, not narrowly as just the doing of research, development, and engineering, but rather as all the effort which bears on the product future of the company. Designation as the prime responsibility of the technical effort function, the provision to management of the expected return for invested dollar, and the carrying out of the technical effort as a secondary responsibility, a decision on total investment, a "walling off" by separate budgeting of the various balanced pieces of the technical effort, so the balance can be maintained in times of stress. ***Van Zandt Williams.*** *Research/Development*, v. 11, Nov. 1960, p. 14 + 7 pages.

g

* **The Climate for Invention.** Attempts to answer three important questions relevant to the subject. They are: What kind of person invents and by what characteristics can he be recognized? What is known about the inventive process? Are methods available to stimulate invention? ***W. H. Middendorf.*** *Insulation*, v. 6, Nov. 1960, p. 19-22.

h

* **Natural Rubber Research.** Summaries of papers presented in Kuala Lumpur in three conferences. Particular emphasis on those applicable to the users of rubber. *Rubber Journal and International Plastics*, v. 139, no. 15, Oct. 8, 1960, p. 526 + 2 pages.

i

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* Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

*** On the Role of Professional Societies in Stimulating and Guiding of Research.** Concludes that: research of any kind is difficult to influence, for better or for worse; professional societies are not in a good position to exert influence on research and will find it difficult to promote it effectively; much of what they can do in this respect, societies are already doing consciously or unconsciously and with the expected poor results; of the avenues open to them, the most promising are seminars convened over several days and attended by small groups of especially selected people; such seminars are being held but some improvement seems possible in the way they are conceived and executed. ***R. F. Drenick.*** *SIAM Review*, v. 2, no. 4, Oct. 1960, p. 241-246.

*** Creativity in Research Organizations.** Analyzes the factors involved in promoting creativity or the faculty of originating new ideas. ***Irving Reich.*** *Research Management*, v. 3, no. 4, Winter 1960, p. 217-225.

*** The Art of Originality.** Continuation of a series on the Art of Industrial Inventing, Working Principle II, Mathematical Analysis. ***Hyman Olken.*** *Electromechanical Design*, v. 4, no. 11, Nov. 1960, p. 52-53.

The Principles of Scientific Research. Presents the development of the process of research: its relationship with social change and available techniques. The principles of the research process: types of problems, methods of attack, and essential disciplines. The support available for research. ***Paul Freedman.*** 2nd Ed. 228 pp. 1960. Pergamon Press, New York. (Q180.A1 F87p2)

Measuring R&D: Here Are Some Suggested Guideposts. Three general methods of assessment are suggested. *Steel*, v. 147, Dec. 12, 1960, p. 47.

Creativity . . A New Appraisal. Presents extracts and ideas from hitherto unpublished sources, shedding further light on the twin problems of industry vs the creative man, and a conservative society that seeks for innovation. ***E. J. Tangerman.*** *Product Engineering*, v. 31, no. 51, Dec. 12, 1960, p. 79-81.

Upgrade Technical Competence. Discusses the problem of solving the obsolescence of technical knowledge. ***Merritt A. Williamson.*** *Research/Development*, v. 11, Dec. 1960, p. 79-84.

The Case of Scientific Management in Science. Concludes that research and development needs scientific management rather than management by scientists. ***Burton F. Barrows.*** *Research/Development*, v. 11, Dec. 1960, p. 93-101.

Defense Spending Trend Breeds Discord. Critics attack division of research and development funds and claim basic research is short-changed. *Chemical and Engineering News*, v. 38, no. 49, Dec. 5, 1960, p. 27-29.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

Support Systems. III. In the Future. Reviews the trends in weapons systems and space missilry and their effects on requirements for support equipment. The most important problem areas of the future for support systems are listed and discussed. These problems are classified according to their mechanical, electronic, architectural, human factors, and operational analysis aspects. ***Richard W. Skulski.*** *Aero/Space Engineering*, v. 19, Nov. 1960, p. 32-35.

Beryllium Research in Missile Development. The limiting problems of Be are primarily related to ductility with ramifications in low impact resistance, catastrophic crack propagation, limited formability, weld brittleness, and sensitivity to surface damage. Means have been found to alleviate these shortcomings, and the considerable elongation at elevated temperatures has been a saving feature for missile application. ***Clayton O. Matthews.*** *Journal of Metals*, v. 12, Oct. 1960, p. 780-785.

*** Reduction of Bending Moment at the Root of a Rotor Blade.** It is shown that a reduction of the bending moments in a helicopter rotor blade may be achieved by replacing an elastic beam-type flapping hinge by a stack of leaf-springs having the same over-all bending stiffness but no shear stiffness. This reduction becomes more pronounced when the tensile load on the flapping hinge is increased. ***H. P. van Leeuwen.*** *Aircraft Engineering*, v. 32, Oct. 1960, p. 309-310.

*** Effect of Structural Damping on Panel Flutter.** By considering a two-dimensional, simply-supported panel and using linear piston theory for the aerodynamic forces an analysis is presented in which the effect of hysteretic structural damping is considered. The main emphasis is on flat unbuckled panels, although a brief investigation of buckled panels is also presented, and it is concluded that there is an interdependence of structural and aerodynamic damping, which in the range of Mach numbers for which piston theory is valid, shows the destabilizing effect of structural damping. This effect is apparently more pronounced at high altitudes. A comprehensive bibliography of panel flutter is also included. ***D. J. Johns and P. C. Parks.*** *Aircraft Engineering*, v. 32, Oct. 1960, p. 304-308.

*** Design for Minimum Weight.** A new approach to the problem of minimum-weight design of stiffened compression panels is presented. It is predominantly based on the plate instability mode in which the sheet and stiffeners, having been stressed to the same degree, simultaneously buckle over a long wavelength with the length of a buckle equal to the pin-ended length of a panel. Charts to determine the buckling stresses of the modes required for the minimum-weight design are given. Formulae and charts are presented to compute the effective moment of inertia of a stiffener, a most important quantity, over a wide range of panel proportions, for Z-section and integrally machined unflanged stiffeners. The principles of minimum-weight design are discussed and illustrated by the lightest Z-stiffener panels selected from extensive test data. Comparison of the theoretical stresses of the optimum panels and many other panels of different proportions with those obtained by tests shows good agreement. The principle of dimensional similarity, which is implicit in the buckling mode, eliminates the effects of size. Results obtained either from theory or tests can therefore be applied to different size panels of like proportions. S. ***Yusuff.*** *Aircraft Engineering*, v. 32, Oct. 1960, p. 288-294.

*** Measurements on Supersonic Free Jets.** An experimental study of round supersonic air jets discharging into quiescent air is described. The initial stagnation enthalpy of the jets was equal to that of the atmosphere. Most of the experiments concerned a fully expanded jet with initial Mach number of 1.74. From the experimental results, the turbulent Prandtl number and the turbulent coefficient of momentum transfer could be calculated in a large part of the mixing zone of the jets. ***L. J. F. Broer and J. A. Rietdijk.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 9, no. 6, 1960, p. 465-477.

*** Design of a Pressurized Missile Body.** The determination of the skin thickness of a cylindrical shell under axial compression is discussed. ***D. S. Houghton and A. S. L. Chan.*** *Aircraft Engineering*, v. 32, Nov. 1960, p. 320-326.

AGRICULTURE

*** Preparation and Properties of Hydroxyethylated High-Amylose Corn Starch.** Aqueous slurries of hydroxyethylated high-amylose starch when cooked to temperatures between 73 and 90 C gave pastes which were fluid in character and had improved dispersion stability on cooling and aging over that of the unmodified starch. In the cooking-cooling cycle, the viscosity curves exhibited by these products are considerably lower than those of similarly substituted waxy and normal corn starches. Improved pasting properties obtained by hydroxyethylation of high-amylose starch indicate promise for this derivative of the new starch in industrial applications. ***J. C. Rankin, J. G. Rull, C. R. Russell, and F. R. Senti.*** *Cereal Chemistry*, v. 37, no. 5, Sept. 1960, p. 656-670.

Case of Apparent Resistance of *Rattus norvegicus* Berkenhout to Anticoagulant Poisons. A case of resistance of *Rattus norvegicus* to anticoagulant poisons "Diphacinone" and "Warfarin" is discussed. ***C. Mary Boyle.*** *Nature*, v. 188, Nov. 5, 1960, p. 517.

BIOCHEMISTRY AND BIOPHYSICS

*** Attempt to Induce Genetic Transformations in Animals by Deoxyribonucleic Acid and Deoxyribonucleoprotein.** Tests conducted on *Mus musculus L*, *Bombyx mori L*, and *Drosophila melanogaster L* had negative results. Stresses the need to develop methods to prevent the denaturation of the introduced preparations by the depolymerizing enzymes of the recipient, and to guarantee better penetration of these preparations into cells. (*In Russian.*) Popytka polucheniia geneticheskikh transformatsiĭ u zhivotnykh s pomoshch'iu dezoksiribonukleinovoĭ kisloty i dezoksiribonukleoproteida. ***S. M. Gershenzon, I. P. Kok, L. V. Samosh, N. M. Turkevich, and N. Ia. Fedorova.*** *Zhurnal Obshchei Biologii*, v. 21, no. 5, Sept.-Oct. 1960, p. 387-389.

Age at Exposure and the Late Effects of X-Rays. Studies With CAF$_1$ Mice Irradiated at 1 to 2 Years of Age. ***Henry I. Kohn and Paul H. Guttman.*** *U. S. Atomic Energy Commission, UCSF-20*, July 31, 1960, p. 40-48 + 14 figures. (UF767 Un3.1ucs Contin.)

*** Induction of Puff Changes in Salivary Gland Chromosones of *Chironomus tentans* by Ecdysone.** After the injection of "ecdysone"—the hormone of the prothoracic glands—into the last instar larvae of *Chironomus tentans*, a new puff in the first chromosome appears, while another one disappears. This effect is produced within two hours. In normal development the changes are characteristic of the metamorphosis. It is postulated that the primary effect of ecdysone is to alter the activity of specific genes. (*In German.*) Induktion von Puff-Veränderungen in den Speicheldrüsenchromosomen von *Chironomus Tentans* Durch Ecdyson. ***U. Clever and P. Karlson.*** *Experimental Cell Research*, v. 20, no. 3, Sept. 1960, p. 623-626.

*** The Behavior of Unicellular Organisms in an Electromagnetic Field.** Unicellular organisms reacted in a variety of ways to high frequency, high voltage electromagnetic fields. Non-motile organisms aligned parallel to the lines of force at frequencies in the lower megacycle range. Non-viable matter has always aligned parallel to the field and formed chains. Motile microorganisms were constrained to travel only parallel to the field at lower frequencies and at right angles to the lines of force at higher frequencies. ***A. A. Teixeira-Pinto, L. L. Nejelski, Jr., J. L. Cutler, and J. H. Heller.*** *Experimental Cell Research*, v. 20, no. 3, Sept. 1960, p. 548-564.

*** Acquired Tolerance of Homologous Kidney Grafts in Dogs.** Specific immunological tolerance to skin homografts could be established in dogs subjected to exsanguination-transfusion in the first days of their life with blood from the prospective skin donor. Tests with kidney homografts on dogs were made. ***A. Gomboš, V. Tischler, and J. Jacina.*** *Transplantation Bulletin*, v. 26, no. 2, Oct. 1960, p. 433-435.

*** Concerning the Ribonuclease Sequence.** ***Richard S. Morgan.*** *Journal of Molecular Biology*, v. 2, no. 4, Oct. 1960, p. 243-245.

*** Experimentally Induced Muscular Dystrophy: Blood Creatine Levels and Histopathological Changes in Dystrophic Rabbits.** Blood levels of creatine may be used to indicate the presence of muscular dystrophy. ***Ollie M. Bowman and I. A. Dyer.*** *Journal of Nutrition*, v. 72, no. 3, Nov. 1960, p. 289-292.

*** Vector Analysis of Ultraviolet Mixture Spectra: the Composition of Ribonucleic Acid.** ***James C. Reid and Arnold W. Pratt.*** *Biochemical and Biophysical Research Communications*, v. 3, no. 4, Oct. 1960, p. 337-342.

*** On the Expression of a Structural Gene.** Integrity of the genetic material is required not only for an initial transfer of genetic information, but actually for enzyme synthesis to continue. ***Monica Riley, Arthur B. Pardee, François Jacob, and Jacques Monod.*** *Journal of Molecular Biology*, v. 2, no. 4, Oct. 1960, p. 216-225.

Correlation of Viral Ribonucleic Acid and Protein Composition. ***Martynas Yčas.*** *Nature*, v. 188, Oct. 15, 1960, p. 209-212.

*** The Nucleic Acid of Polyoma Virus.** The nucleic acid of polyoma (PY) virus was identified as DNA by the isolation of P^{32}-labeled deoxyribonucleotides from purified P^{32}-labeled PY virus. The inhibition of the multiplication of PY virus by aminopterin and bromodeoxyuridine is described. Since both inhibitors are known to affect the synthesis of DNA, the results with both metabolic inhibitors support the conclusion that PY virus contains DNA as the essential nucleic acid. ***J. D. Smith, G. Freeman, M. Vogt, and R. Dulbecco.*** *Virology*, v. 12, no. 2, Oct. 1960, p. 185-196.

*** Action of an Interferon Produced by Malignant Cells, on the Experimental Infection of the Newborn Hamster by Means of the Polyoma Virus.** An inhibitor prepared from Po Ha cells, prolonged the life of infected animals, diminished the amount of tumor or, to a large extent, delayed their appearing. Some animals inoculated with the virus and the inhibitor exhibited no visible tumors after over 200 days, whereas the control animals, after receiving the virus only, died with tumors histologically discovered about 28 days after inoculation. The inhibitor, similar to interferon, may decrease the multiplication of the particles responsible for the oncogenic action below a certain critical level. (*In French.*) Action d'un interféron provenant de cellules malignes sur l'infection expérimentale du Hamster nouveau-né par le virus du polyome. ***Pascu Atanasiu and Charles Chany.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 16, Oct. 17, 1960, p. 1687-1689.

*** Immunological Differences Between Normal and Malignant Cells.** Findings suggest that mammalian cells contain organ-specific antigen or antigens which are lost or depleted when the cells become malignant, whether the malignancy is chemically induced or spontaneous. Rat liver and hepatoma, hamster kidney and renal carcinoma, human skin and various skin tumors were compared. ***R. C. Nairn, H. G. Richmond, M. G. McEntegart, and J. E. Fothergill.*** *British Medical Journal*, no. 5209, Nov. 5, 1960, p. 1335-1340.

*** Aminooxydases. Enzymes of Interest for Psychiatry.** The paper deals with the enzymes monoamine oxidase, spermine oxidase, and benzylamine oxidase. A survey is given of their occurrence, structure, substrates, inhibitors, and physiologic functions. (*In Swedish.*) Aminooxidaser. Enzymer av intresse för psykiatrin. ***Edith Heilbronn.*** *Svensk Kemisk Tidskrift*, v. 72, no. 9, 1960, p. 565-586.

*** X-Ray Induced Chromosome Damage in Man.** The data indicate that X-rays readily produce chromosome damage which can be detected in cultures of human blood-cells. ***Ishbel M. Tough, Karin E. Buckton, A. G. Baikie, and W. M. Court-Brown.*** *Lancet*, no. 7155, Oct. 15, 1960, p. 849-851.

*** The Effect of Light and of Radiation on the Autoxidation of Cysteine and the Reaction Between Cysteine and 3,4-Benzpyrene.** The oxidation of cysteine alone was observed under the following conditions: in darkness, in UV, and under X-irradiation; and also of cysteine mixed with a suspension of 3,4-benzpyrene under the same conditions. Undoubtedly UV accelerates the oxidation of cysteine both alone and in the presence of the cyclic hydrocarbon. When X-irradiated, the increase of cysteine-oxidation can only become effective after a total dose of approximately 4000 r. (*In German.*) Der Einfluss des Lichtes und ionisierender Strahlung auf die Autoxydation von Cystein und die Reaktion zwischen Cystein und 3,4-Benzpyren. ***R. Koch and J. Fränz.*** *International Journal of Radiation Biology*, v. 2, no. 4, Oct. 1960, p. 383-392.

*** An Analysis of the Concept of Cellular Injury and Death.** In the terms of functional sub-units of the cell the following changes may take place; inactivation or alteration of enzymes; modification of templates for synthetic process; and alteration and decomposition of metabolites, intermediates, and co-factors. An analysis is made of how cellular processes may be affected by

external agents and how functional disorganizations may occur. ***F. Heinmets.*** *International Journal of Radiation Biology*, v. 2, no. 4, Oct. 1960, p. 341-352.

* **The Use of Polystyrene-Allergen Conjugates for the Removal of Antibodies From Sera of Allergic Individuals.** Polystyrene-ragweed conjugates were shown to remove specific antibodies from sera of individuals allergic to ragweed. This observation is considered evidence that firm combination occurs *in vitro* between allergic antibodies and the homologous allergens. Comparative analyses of allergic sera before and after exposure to immunosorbents indicated that complete removal of skin-sensitizing, blocking, and hemagglutinating antibodies did not result in a measurable decrease in protein concentration, thus demonstrating that these factors are present only in minute amounts. ***L. Gyenes and A. H. Sehon.*** *Canadian Journal of Biochemistry and Physiology*, v. 38, Nov. 1960, p. 1249-1253.

* **Preparation and Evaluation of Polystyrene-Antigen Conjugates for the Isolation of Antibodies.** Antigenically specific adsorbents were prepared by coupling soluble protein antigens to a polystyrene-supporting medium by azo bonds. These immunosorbents were shown to combine specifically with homologous precipitating rabbit antibodies. Elution of precipitating antibodies from the immunosorbents was achieved by dissociation with hydrochloric acid at pH 3. Under optimal conditions, 35% of the antibodies removed from the antisera were recovered with a purity of over 80%. ***L. Gyenes and A. H. Sehon.*** *Canadian Journal of Biochemistry and Physiology*, v. 38, Nov. 1960, p. 1235-1248.

* **Biological Clocks in Medicine and Psychiatry: Shock-Phase Hypothesis.** ***Curt P. Richter.*** *National Academy of Sciences, Proceedings*, v. 46, Nov. 1960, p. 1506-1530.

* **The Complete Amino Acid Sequence of the Protein of Tobacco Mosaic Virus.** On the basis of new and previously published data, a complete sequential arrangement of the 158 amino acid residues of the protein subunit of tobacco mosaic virus is reported. ***A. Tsugita, D. T. Gish, J. Young, H. Fraenkel-Conrat, C. A. Knight, and W. M. Stanley.*** *National Academy of Sciences, Proceedings*, v. 46, Nov. 1960, p. 1463-1469.

Thermal and Electrical Properties of Nucleic Acids and Proteins ***J. Duchesne, J. Depireux, A. Bertinchamps, N. Cornet, and J. M. van der Kaa.*** *Nature*, v. 188, Oct. 29, 1960, p. 405-406.

* **The Effect of *Proteus morganii* Endotoxin on Radiation Mortality in Mice.** A single 3-μg injection of *Proteus morganii* endotoxin decreases radiation mortality in mice. The extent of reduction of mortality and the range in time of effective treatment are functions of the radiation dose to which the animals are exposed. The greatest reduction in mortality was observed if endotoxin was given 24 hr before irradiation; under these circumstances, mortality was reduced from 71% to 2%. ***E. J. Ainsworth and M. H. Hatch.*** *Radiation Research*, v. 13, no. 4, Oct. 1960, p. 632-638.

Progress in the Chemistry of Organic Natural Products. v. XVIII. (*In German, French, and English.*) Fortschritte der Chemie Organischer Naturstoffe. ***L. Zechmeister, editor.*** v. XVIII. 600 pp. 1960. Springer-Verlag, Vienna, Austria. (QD245 F77c Vis.)

* **Infection of Protoplasts of *Escherichia coli* by Subviral Particles of Bacteriophage ϕX174.** Infection of protoplasts of various strains of *Escherichia coli* may be obtained with purified DNA preparations from bacteriophage ϕX174 made by two distinctly different methods. None of the particles, infective to protoplasts, are infective to whole cells. ***George D. Guthrie and Robert L. Sinsheimer.*** *Journal of Molecular Biology*, v. 2, no. 5, Nov. 1960, p. 297-305.

* **Nucleic Acid Metabolism in HeLa S3 Cells After X-Ray-Induced Mitotic Delay.** A depression in the percentage of cells in DNA synthesis accompanies resumption of mitosis, but is followed by a return to near-normal values, in the evolving giant cell population. As the number of cells in the population decreases, owing to abortive divisions, the percentage of cells in synthesis slowly decreases. One of the effects of irradiation appears to be a mixing of the cells in the S and G_2 phases of the population at the time of irradiation, so that cells from both compartments are in the population of cells that begin dividing after mitotic delay. ***Robert B. Painter.*** *Radiation Research*, v. 13, no. 5, Nov. 1960, p. 726-736.

Reaction of Formaldehyde With Deoxyribonucleic Acid in Phage *T1*. The fact that the ratio of reactivable to nonreactivable hits is the same in the case of formaldehyde and ultraviolet inactivation makes a formaldehyde reaction with the deoxyribonucleic acid most probable. ***Walter Sauerbier.*** *Nature*, v. 188, Oct. 22, 1960, p. 327-329.

Effects of Ultra-Violet Light on Hydrogen Bonds in Deoxyribonucleic Acid of Phage *T1*. The number of amino-groups accessible for formaldehyde increases with greater doses of ultraviolet light, which indicates that H bonds are broken by the irradiation and that each break does not lead to an inactivation of the phage. As has been shown, the H bonds broken by ultraviolet irradiation do not rejoin during a storage time of 24 hr. ***Walter Sauerbier.*** *Nature*, v. 188, Oct. 22, 1960, p. 329-330.

An Algae Life Support System. It is feasible to support life of animals for 28 days or longer with green algae in a closed system. There is no accumulation of atmospheric ingredients which are toxic. Bacterial metabolism interferes with life support. Rapid, reproducible, and sustained growth of the algae, harvesting and replacement of the medium, and balance of the R.Q. of animal and plant are needed for long-term use in space. ***Russel O. Bowman and Fred W. Thomae.*** *Aero/Space Engineering*, v. 19, Dec. 1960, p. 26 +4 pages.

CERAMICS AND CONCRETE

* **Influence of Vibrations and Ultrasonic Waves on the Formation of the Structure of Hardening Cement Paste.** The increase of the strength of the cement paste with high frequency vibration and ultrasonic action is conditioned not by the depth of hydration, but by the complementary contraction with displacement of some of the free water in connection with the activation of the physico-chemical processes during the structural formation due to coagulation. The complementary concentration appears as a result of the separation of the floccules into different grains without dispersion. (*In Russian.*) Vliianie vibratsii i ul'trazvukovykh kolebaniĭ na formirovanie struktury tsementnogo kamnia. ***I. N. Akhverdov and M. A. Shalimo.*** *Beton i Zhelezobeton*, 1960, no. 9, Sept., p. 403-408.

Microstructure of Sintered Beryllia. A series of photographs illustrates the structure of beryllia ceramics made from BeO of different degrees of purity and submitted to various heat-treatments and to hot-pressing. ***E. Ryshkewitch.*** *British Ceramic Society, Transactions*, v. 59, Aug. 1960, p. 303-314.

High-Temperature Short-Time Creep of Graphite. Constant-load tensile creep properties were determined at 3000 to 5300 F. Creep rates of 10^{-7} to 10^{-3} sec^{-1} were observed at stresses of 1600 to 4000 lb per sq in. The creep rate increased continuously with increasing temperature, and was lower when the streses was parallel to the grain rather than perpendicular. Elongations up to 40% and density decreases up to 18% were observed. Activation energies of 159 to 240 kcal/mol were obtained. ***H. E. Martens, L. D. Jaffe, and D. D. Button.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 782-787.

Recovery Properties of Lithium-Fluoride Single Crystals. The recovery properties of compression-deformed lithium-fluoride single crystals were investigated as a function of prior strain, annealing time, and annealing temperature. The recovery process was studied by observation of etch pits and birefringence stress patterns. The recovery process involved first a redistribution of the dislocations and then a decrease in their number. Only by annealing at high temperatures after small strains (<0.02 in. per in.) was it possible to obtain complete recovery of mechanical properties. ***W. L. Phillips, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 947-951.

Elevated Temperature Properties of Lithium-Fluoride and Magnesium-Oxide Single Crystals. The plastic properties of lithium fluoride and magnesium oxide under compression were investigated in the temperature range 25 to 1000 C. At the higher test temperatures, the critical resolved shear stress and the rate of work-hardening of both materials decreased. At the same time, the number of stress lines decreased and the individual stress lines became wider. The density of dislocations decreased for a given strain the higher the test temperature for lithium fluoride. ***W. L. Phillips, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 939-947.

On the Strength of Glass in Water Vapor. The observed strength did not decrease steadily with increasing vapor pressure, but had a secondary maximum at a relative pressure of about 0.2. The maximum reduction of the strength corresponding to complete wetting with water was already reached at a relative pressure of about 0.5. ***F. R. L. Schoening.*** *Journal of Applied Physics*, v. 31, Oct. 1960, p. 1779-1784.

* **Some Causes of Bloating in Expanded Clay and Shale Aggregates.** The mechanism of bloating was studied in a number of clays and shales which could be bloated in the rotary kiln. The most common gas-producing reaction was found to be the reduction of iron oxide to the ferrous state; in the samples studied, the evolution of CO_2 from carbonates was not important. The ferrous oxide can be combined as magnetite or fayalite, or may be dissolved in a glass. Elemental S derived from the reaction of ferrous sulphide with O was also a cause of bloating. Requirements for good bloating are from 3 to 10% of alkali and alkaline earth oxides and from 5 to 15% of iron oxide. ***R. D. Hill and D. N. Crook.*** *Australian Journal of Applied Science*, v. 2, no. 3, Sept. 1960, p. 374-384.

* **Mechanism of the Retardation of the Set of Gypsum Plaster.** A number of retarders were studied. The results are interpreted in terms of a mechanism of setting proposed earlier (Ridge 1959), and the conclusions are supported by evidence derived from the microscopic examination of retarded plasters after setting. In general, the retarders studied act by poisoning nuclei for the growth of calcium sulfate dihydrate and the effectiveness of some retarders depends upon the type of nucleus present. However, the actions of some retarders such as citrates, borates, and sodium hexametaphosphate are complicated by other processes including inhibition of the growth of the dihydrate, which appears to be the main effect of calcium acetate. It appears that retarders may be consumed during the reaction, and the length of the induction period of retarded mixtures may be partly determined by the rate of consumption of the retarder. It is pointed out that evidence derived from dilute slurries of calcium sulfate hemihydrate and supersaturated solutions of calcium sulfate bears only indirectly on the processes that are important in pastes which are concentrated enough to set. ***M. J. Ridge and H. Surkevicius.*** *Australian Journal of Applied Science*, v. 2, no. 3, Sept. 1960, p. 385-398 + 4 plates.

New Methods of Preparing Plaster Molds. Use of vacuum; mass-production techniques. (*In German.*) Neue Wege in der Gipsformenherstellung. ***K. Litzow.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 37, Sept. 1960, p. 434-441.

The Use of Small Specimens in Cement Testing. Previous work on the use of small specimens for testing cement is reviewed and some new work done with ½-in. vibrated mortar cubes is described. Programs of work involving the use of such cubes are outlined to demonstrate the value of the technique used. ***J. A. Forrester and R. A. Keen.*** *Journal of Applied Chemistry*, v. 10, pt. 9, Sept. 1960, p. 358-365.

The Sintering of Glass as a Function of Surface Tension and Viscosity. A description is given of model experiments on glass capillary tubes in which the action of the surface tension as a driving force for the sintering process may be partially or totally compensated by applying a pressure. The surface tension is determined by a compensation method and viscosity measurements are carried out at large deformation and constant stress. (*In German.*) Das Sintern von Gläsern als Auswirkung von Zähigkeit und Oberflächenspannung. ***H. J. Oel.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 37, Sept. 1960, p. 424-428.

Development of a Complex Silicon Nitride-Bonded Silicon Carbide Refractory. A complex silicon nitride (Si_3N_4) is being used to bond SiC, thereby developing a relatively inexpensive product with superior characteristics and properties. It has high physical strength and excellent resistance to various corrosive media, oxidation and wear. Thus, the primary disadvantage of high cost of previously available nitride-bonded SiC has been overcome, opening many fields of application. ***Malcolm E. Washburn.*** *Industrial Heating*, v. 27, Oct. 1960, p. 2215 + 8 pages.

Quantitative Determination of the Four Major Phases in Portland Cements by X-Ray Analysis. Describes method for the direct determination of the four major phases (tricalcium silicate, dicalcium silicate, tricalcium aluminate and calcium aluminoferrite) as well as of the composition of the calcium aluminoferrite phase which appears to have possibilities to replace chemical analysis and potential compound calculation in industrial practice. ***Stephen Brunauer, L. E. Copeland, D. L. Kantro, C. H. Weise, and Edith G. Schulz.*** *Portland Cement Association, Research Department Bulletin* 113, 1959, p. 1091-1100. (TP883 P83b Vis.)

* **The Service of Refractories in Ferroalloy Produciton Converters.** A decisive factor determining the resistance of refractories in converters melting low-carbon ferro-chromium is the composition of the initial metal, especially the Si contained in it. To improve the operation of the converter, it is advisable to reinforce the lining of the tuyere zone and to use better refractories, e.g., fused magnesite; the rest of the brickwork can be made of periclase-spinel bricks. (*In Russian.*) O sluzhbe ogneuporov v konverterakh ferrosplavnogo proizvodstva. ***A. N. Gaodu.*** *Ogneupory*, v. 25, no. 9, 1960, p. 405-410.

* **Contribution on the Study of Glazes for Zircon Porcelains.** Describes a study of a series of glazes for industrial porcelain. The firing temperature was 1200-1250 C. Thermal expansion, temperatures of softening and firing, color, brilliancy, texture, dielectric constant, and dielectric loss factor were determined. (*In French.*) Contribution à l'étude des glaçures pour porcelaines au zircon. ***D. A. Estrada and C. Sanchez Conde.*** *Silicates Industriels*, v. 25, no. 10, Oct. 1960, p. 457-462.

Battelle Memorial Institute. Discusses present status of ceramic investigations at Battelle and describes facilities available for conducting research. ***Winston Duckworth.*** *Ceramic Age*, v. 76, no. 4, Oct. 1960, p. 27-32.

Dynamics of Crack Propagation in Glass. An expression for the velocity of crack propagation in a brittle medium is derived on the basis of the distortion energy at the crack surface. Agreement with Mott's equation and with Schardin's experiments on vitreous silica and a number of optical glasses is good. ***Sydney Bateson.*** *Physics and Chemistry of Glasses*, v. 1, no. 5, Oct. 1960, p. 139-142.

* **A Contribution to the Study of the Viscosity of Glasses. I. Effects of Temperature and Composition.** Viscosity measurements between 10^9 and 10^{17} poises were made by determining the isothermal value of a glass rod under the effect of a constant stress. Other measurements were taken up to 10^{20} poises by studying the curvature of a glass plate subjected to a load for several months. (*In French.*) Contribution a l'étude de la viscosité des verres. I. Influence de la température et de la composition. ***Micheline Prod'homme.*** *Verres et Réfractaires*, v. 14e, no. 4, July-Aug. 1960, p. 193-205.

* **Study of the Reaction Between Glaze and Body by the Traced Atom Method.** The variation in the composition of the glaze by introducing certain oxides under otherwise equal conditions can produce a considerable change of the diffusion properties of the glaze and a real effect on the thickness of the zone of reaction. Zn, Fe, Pb and borax oxides increase the diffusion properties of Ca. Zirconium decreases the degree of reaction between glaze and body. (*In Russian.*) Izuchenie vzaimodeĭstviia glazuri s cherepkom metodom mechenykh atomov. ***E. I. Zavarzina.*** *Steklo i Keramika*, v. 17, no. 10, Oct. 1960, p. 26-30.

* **Investigation of Some Hydraulic Cements in the System BaO-Al_2O_3-SiO_2.** Production and properties of barium-aluminum oxide and strontium-aluminum oxide cements. (*In Russian.*) Issledovanie nekotorykh gidravlicheskikh viazhushchikh v sisteme BaO-Al_2O_3-SiO_2. ***T. Ionesku and Al. Braniski.*** *Tsement*, v. 26, no. 5, Sept.-Oct. 1960, p. 11-13.

Insulating Firebrick for Periodic Kilns. An up-to-date analysis of the increased use of insulating firebrick in the structural clay products industry, and a discussion of reduced construction and operating costs in periodic kilns through the use of insulating firebrick. ***Roy C. Shehane and Paul R. McClafferty.*** *American Ceramic Society Bulletin*, v. 39, Dec. 1960, p. 721-726.

Aerodynamic Classified Talcs and Their Effect in a Ceramic Body. A partial elimination of extremely fine particles in commercial talcs increased the bulk density, and together with an increase in line content, lowered the shrinkage. The color of the coarse fraction of the talcs was darker than that of the unfractionated talcs. ***Ernest Felton and Robert Watterlond.*** *American Ceramic Society Bulletin*, v. 39, Dec. 1960, p. 717-720.

CHEMICAL ENGINEERING

* **Some Observations on the Synthesis of Diamonds.** ***Halvard Liander and Erik Lundblad.*** *Arkiv för Kemi*, v. 16, nos. 1-2, 1960, p. 139-149.

Nonmilitary Defense. Chemical and Biological Defenses in Perspective. Advances in Chemistry Series No. 26. This transcript of a symposium held at the recent Cleveland ACS meeting is outspoken and direct and aims to remove public apathy by direct information, rather than alarming statements. The 13 papers cover both governmental and individual measures for fighting RW, BW, and CW attack. 100 pp. July 1960. American Chemical Society, Washington 6, D. C. (UG447 Am35n)

* **Reactions Between Granular Solids and Fluids in Continuous Reactors.** Relations are derived for the distribution functions of the residence times of dispersed solids. ***V. Vaněček.*** *Collection of Czechoslovak Chemical Communications*, v. 25, no. 9, Sept. 1960, p. 2395-2404.

The Critical Temperatures of Forty Organic Compounds. Precise measurements have been made of the critical temperatures of pure specimens of compounds from the paraffin, olefin, cyclopentane, cyclohexane, benzene, pyridine and naphthalene series. The visual method of determining the critical point was employed, and observed critical temperatures are believed accurate to within 0.1° in most instances. ***D. Ambrose, J. D. Cox, and R. Townsend.*** *Faraday Society, Transactions*, v. 56, Oct. 1960, p. 1452-1459.

* **New Process for Stereospecific Rubbers.** The continuous production of the above, such as polyisoprene, polybutadiene, and ethylene-propylene copolymers. Offers lower capital investment and operating costs. *Rubber and Plastics Age*, v. 41, Oct. 1960, p. 1168-1169.

* **Drying.** Reviews new developments in the theory and application of drying. ***W. F. Calus.*** *Chemical & Process Engineering*, v. 41, Oct. 1960, p. 448-452.

How to Design Packed-Tower Absorbers. Proper evaluation of mass transfer coefficients is fundamental in establishing height of a transfer unit and number of units for packed-tower absorbers. ***Jesse Coates and Bernard S. Pressburg.*** *Chemical Engineering*, v. 67, Oct. 31, 1960, p. 109-114.

* **Aerosol Documentary.** Presents the eighth in a series of special-interest editorial features. This one covers aerosols and contains 18 different articles. *American Perfumer*, v. 75, Oct. 1960, p. 37 + 46 pages.

New Surfactants Listed. Fifth revision includes only new or previously unlisted detergents and emulsifiers. ***John W. McCutcheon.*** *Soap and Chemical Specialties*, v. 36, Oct. 1960, p. 53-62.

* **Distillation for Marine Purposes.** ***R. G. Peaver.*** *Institute of Marine Engineers, Transactions*, v. 72, Sept. 1960, p. 339-362.

Advances in Catalysis and Related Subjects. Six papers review studies of current interest. ***D. D. Eley, P. W. Selwood, and Paul B. Weisz, editors.*** v. XII. 324 pp. 1960. Academic Press, New York. (QD501 A95c Vis.)

Chemistry and Technology of Fertilizers. American Chemical Society Monograph Series No. 148. Contains 24 papers on different aspects of the industry. ***Vincent Sauchelli, editor.*** 692 pp. 1960. Reinhold Publishing Corp., New York. (TP693 Sa85c)

* **A Study of the Polymerization of Gaseous Formaldehyde in Macromolecular Products.** The influence of different parameters, including the origin of gaseous formaldehyde, the process medium, the amount and the grade of initiators, the presence of stabilizer, the temperature, and the rate at which monomer is introduced, on the course of the polymerization of gaseous CH_2O were studied. (*In Polish.*) Badania polimeryzacji gazowego formaldehydu na produkty wielkocqsteczkowe. ***Maria Tomaszewicz, Jerzy Fejgin, and Lech Zakrzewski.*** *Przemysł Chemiczny*, v. 39, no. 8, Aug. 1960, p. 509-513.

* **Application of the Thermogravimetric Method in the Study of Flameproofing Effectiveness of Impregnating Agents.** A study of the combustion rate in air of samples of paper, straw, two grades of wood and three grades of fabric, nonimpregnated and impregnated with a commercial impregnating agent (ammonium-phosphate type). Presents an objective basis for the evaluation of the effectiveness of flameproofing impregnating agents. (*In Polish.*) Zastosowanie metody termograwimetrycznej do badania skuteczności działania przeciwpłomieniowych środków impregnujqacych. ***Jerzy Trau.*** *Przemysł Chemiczny*, v. 39, no. 8, Aug. 1960, p. 514-516.

* **The Treatment of Nitric Acid Plant Tail Gas.** Outlines the most recent catalytic combustion technique for eliminating nitrogen dioxide. ***W. Fletcher.*** *British Chemical Engineering*, v. 5, Nov. 1960, p. 789-790.

Activated Alumina for Gas Drying. ***Dieter Janchen.*** *Chemical Engineering*, v. 67, Oct. 31, 1960, p. 115-116.

New Data on Entrainment From Perforated Trays at Close Spacings. A dynamic system in equipment that is large enough to permit use of the results for commercial designs. ***L. Friend, E. J. Lemieux, and W. C. Schreiner.*** *Chemical Engineering*, v. 67, Oct. 31, 1960, p. 101-108.

Liquid-Liquid Extraction Between Rotating Concentric Cylinders. To attain residence times of 5 to 10 seconds per stage, extraction was carried out in the annulus between rotating concentric cylinders. ***M. W. Davis, Jr. and E. J. Weber.*** *Industrial and Engineering Chemistry*, v. 52, Nov. 1960, p. 929-934.

Purifying Olefins by Catalytic Hydrogenation. Acetylenes and propadiene are reduced to 10 p.p.m. or lower by hydrogenation over catalysts consisting of supported Pd, or Pd in combination with another metal. ***Holger C. Andersen, Alfred J. Haley, and Walter Egbert.*** *Industrial Engineering Chemistry*, v. 52, Nov. 1960, p. 901-904.

Synthetic Phenol. New routes to phenol synthesis are considered. ***Louis A. Agnello and William H. Williams.*** *Industrial and Engineering Chemistry*, v. 52, Nov. 1960, p. 894-900.

Planning and Research Can Help Meet Industry's Water Needs. An optimistic view of the demand for industrial water which is expected to double in the next 20 years and could almost double again in 20 more years. ***P. J. Cathey.*** *Iron Age*, v. 186, no. 17, Oct. 27, 1960, p. 55-57.

* **Design and Construction of Pressure Vessels.** Discusses the broad principles involved in the design and construction of pressure vessels. Describes some particular problems associated with the fabrication of a nuclear reactor. ***J. J. Haftke.*** *Chemical & Process Engineering*, v. 41, Oct. 1960, p. 437 + 6 pages.

Polyolefin Processes Today. Reviews state of the art in polyolefin resin processes. Based on an extensive patent and literature search, this comprehensive article shows where polyolefins stand today. ***Marshall Sittig.*** *Petroleum Refiner*, v. 39, Nov. 1960, p. 162-222.

* **Multiflash Distillation of Sea Water.** Seventy-five per cent of the world's potable water distilled from sea water is produced

by some 56 distillation plants employing the multiflash system. Many years of experience and research have led to improvements of this system. Process operation, and economics are discussed. ***F. C. Livingstone.*** *Water & Sewage Works*, v. 107, Nov. 1960, p. 413-416.

* **Metallic Materials of Construction for the Chemical Industry.** Cast-iron fusion pots are used in the manufacture of phenol from benzol. Austenitic cast iron can be used at elevated temperatures. High silicon cast iron is used for valves. Austenitic stainless steel is the one most commonly used in the petroleum industry and in atomic energy plants. The presence of Mo in stainless steel increases the resistance to non-oxidizing acids. Nickel has remarkable resistance to corrosion by caustic alkalies. Pure Al is used for handling red and white fuming nitric acid and H_2O_2. Tantalum and Ti resist wet chlorine and aqua regia. ***G. W. Brewer.*** *Corrosion Prevention & Control*, v. 7, Nov. 1960, p. 35-39.

Three Nomographs Aid in Designing Pressure Vessels. The Barlow thin-wall equation, the conservative thin-wall equation and the thick-wall equation are discussed. ***F. Kaplan.*** *Product Engineering*, v. 31, no. 47, Nov. 14, 1960, p. 78 + 2 pages.

* **Moving Bed Catalytic Cracking.** The HB Houdriflow process, process design methods, fundamentals of gravity solids flow, fundamentals of vapor flow in solids beds, heat transfer in moving beds are discussed. ***A. Wesley Hoge, Richard E. Ashwill, and Edward A. White.*** *Petroleum Engineer*, v. 32, Nov. 1960, p. C44-C51.

* **Catalytic Cracking Process Design.** Feed stocks, conversion and yields, dense phase reactor design, transport reactors, multiple reactor systems, regenerator, pressure balance, heat balances, light ends facilities, utilities, new developments in process design are discussed. ***William C. Chatman, Chia Wei Chen, and George T. Atkins.*** *Petroleum Engineer*, v. 32, Nov. 1960, p. C37-C43.

* **What You Should Know About Catalytic Cracking.** Catalytic cracking proceeds according to a carbonium ion mechanism while thermal cracking occurs via a free radical mechanism. Aspects are discussed. ***J. F. Crocoll and R. D. Jaquay.*** *Petroleum Engineer*, v. 32, Nov. 1960, p. C24-C30.

* **Preparation of Distilled Water.** The device described is based on filtering steam through a fritted glass plate. This filtering process prevents vesicular losses and cleans the vapor. The detachable device can be adjusted to the apparatus already existing in the laboratory. The dry residue does not exceed a few tenths of a mg./liter and its resistivity is as high as one million ohm/cm. (*In French.*) Préparation d'eau distillée. ***Antoine A. Guntz.*** *Société Chimique de France, Bulletin*, 1960, nos. 8-9, Aug.-Sept., p. 1665-1666.

* **The Fluidized Bed Theory.** The dimensions of a fluidized bed, the transport of particles in a fluidized bed, and some examples are discussed. A nomenclature is cited. (*In German.*) Zur Theorie der Wirbelschicht. ***Jaroslav Beránek.*** *Chemische Technik*, v. 12, no. 9, Sept. 1960, p. 515-520.

* **High Pressure and Artificial Diamonds.** High pressure generation and artifical diamonds are discussed. (*In German.*) Hochdruck und künstliche Diamanten. ***R. H. Wentorf.*** *Chemische Technik*, v. 12, no. 9, Sept. 1960, p. 531-533.

* **Problems of Radioactive Waste Disposal.** Report on recent congress in Milan. *Nuclear Energy*, Dec. 1960, p. 583-585.

A Survey of the Chemical Utilization of Propylene. Production of glycerine, propylene oxide, and propylene glycol from propylene. ***Peter W. Sherwood.*** *Industrial Chemist*, v. 36, Nov. 1960, p. 542-546.

* **Controlling Gas Hydrates.** Composition, causes, and control. ***L. E. Connealy.*** *Gas*, v. 36, Nov. 1960, p. 101-108.

* **Measurement of the "Volume Fraction" of a Liquid-Liquid Dispersion by Conductimetry. Application to the Pulsation Column.** The electrical conductivity of a liquid-liquid dispersion (type: water-heptane) is dependent only on the "volume fraction" of the dispersed phase as long as spherical

particles, fine and uniform enough, are concerned. Shows first that the theoretical expressions for conductivity are satisfactory for the case of mechanically sustained emulsions. (*In French.*) Mesure de la ((fraction volumique)) d'une dispersion liquide-liquide par conductimétrie. Application à la colonne à pulsations. ***D. Defives, C. Reed, and A. Schneider.*** *Chimie & Industrie (Génie Chimique)*, v. 84, no. 4, Oct. 1960, p. 120-129.

* **New Process for Boron Trichloride Production.** The production of BCl_3 has been studied, by reaction between B_2O_3, C, and Cl_2 in a fused-salt bath. Influence of reaction temperature, Cl flow, reagent concentration in the mixture, quality of C used as reducing agent, and of the fused salt bath used, has been examined. (*In Italian.*) Nuovo metodo per la produzione di tricloruro di boro. ***M. Baccaredda and G. F. Nencetti.*** *Chimica e l'Industria*, v. 42, Oct. 1960, p. 1084-1090.

How to Select Demineralization Systems. From these data one can select basic resins and system types and also determine capital investment and operating costs for ion-exchange water-treatment systems. ***N. H. Prater and D. W. Antonacci.*** *Petroleum Refiner*, v. 39, Nov. 1960, p .261-266.

CHEMISTRY—ANALYTICAL

* **Gas Chromatography of Adrenal Cortical Steroid Hormones.** ***W. J. A. VandenHeuvel and E. C. Horning.*** *Biochemical and Biophysical Research Communications*, v. 3, no. 4, Oct. 1960, p. 356-360.

A Modified Tin-Flux Technique for Determination of Oxygen in Titanium. The standard Walter method of determination of O in Ti was reinvestigated and a modified tin-flux procedure was developed. The extraction of O_2 was carried out at 1950 C without the use of graphite chips or crucible lid, which were considered essential by early workers. Also, conditions for rapid degassing of the crucible assembly were established. ***Ch. Venkateswarlu and Manley W. Mallett.*** *Analytical Chemistry*, v. 32, Dec. 1960, p. 1888-1890.

Volumetric Determination of Germanium. The method for the iodimetric titration of Ge is described. By simple distillation from a hydrochloric acid solution, macro amounts of Ge are separated from interfering elements. The Ge distillate is reduced by hypophosphite to divalent Ge and titrated iodimetrically. ***George J. Abel, Jr.*** *Analytical Chemistry*, v. 32, Dec. 1960, p. 1886-1887.

Spectrophotometric Determination of Selenium in Steroids. Selenium is separated from the organic compound using Raney Ni and is then oxidized to selenous acid with concentrated nitric acid. The selenous acid is reacted with o-phenylenediamine to form 1,2,3-benzoselenodiazol which has an absorbance maximum at 330 mμ. The method is fast and applicable to 10 to 150 p.p.m. of Se. ***Lewis J. Throop.*** *Analytical Chemistry*, v. 32, Dec. 1960, p. 1807-1809.

A Method for Detecting Hydrogen in Gas Mixtures. The selective diffusion of hydrogen in Pd has been employed to determine the presence of H_2 qualitatively and quantitatively in different gas mixtures. It was found possible to determine concentrations of H_2 from 100% to 0.001%, or about ten parts per million, in N_2. Also it was found possible to detect the presence of H_2 at a partial pressure of 10^{-7} mm Hg. This would indicate that it is possible to determine the presence of H_2 in concentrations of one part in 10^{19} in a gas atmospheric pressure. There is reason to believe that this technique could be extended even further perhaps to one part in 10^{14} with proper care and presently existing high vacuum techniques. ***J. R. Young and N. R. Whetten.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1112-1114.

* **Spectrophotometric Determination of Molecular Weights of Some Intracomplex Compounds.** The applicability of the spectrophotometric method of determination of molecular weights of intracomplex compounds formed by derivatives of 8-hydroxyquinoline of the type of Mannich bases with series of two-valence cations is discussed. (*In Russian.*) Spektrofotometricheskoe opredelenie molekuliarnykh vesov nekotorykh bny-

trikompleksnykh soedinenii. ***E. P. Trailina, V. V. Zelentsov, I. A. Savich, and V. I. Spitsyn.*** *Akademiia Nauk, SSSR, Doklady*, v. 134, no. 4, Oct. 1960, p. 848-849.

*** Rapid Reductometric Determination of Manganese in Alloys and Minerals.** In volumetric Mn determination on the basis of the oxidation of perchloric acid, the results are always too low. The reason for this is explained. The Mn determination method described is based on the oxidation of Mn with K bromate in the presence of concentrated phosphoric acid and on the reductometric titration of the trivalent Mn produced by an Iron (II) or hydroquinone solution as a mass liquid. (*In German.*) Rasche reduktometrische Bestimmung von Mangan in Legierungen und Mineralien. ***Ivan Kluh, Jan. Doležal, and Jaroslav Zyká.*** *Zeitschrift für Analytische Chemie*, v. 177, no. 1, 1960, p. 14-20.

*** Electrometric Titration of Hydrazine With Cerium(IV) Sulphate.** Direct electrometric titration with cerium(IV) sulphate at 50-55 C using manganese(II) or chromium(III) sulphate as catalyst. The average Ce^{IV}-hydrazine ratio has been found to be 1.016. Advantages are a direct procedure not involving the intermediate use of ferricyanide and the consumption of ceric sulphate is about a quarter of what is required in the existing methods involving the intermediate use of ferricyanide. ***P. V. Krishna Rao, I. Subramanyam, and G. Gopala Rao.*** *Zeitschrift für Analytische Chemie*, v. 177, no. 1, 1960, p. 36-41.

*** Determination of Methylbenzenesulfonate in the Presence of Tetrapropylenebenzenesulfonate in Liquid Washing Agent.** The aqueous solution of the alcohol soluble substances of the washing agent is titrated with a cationic in the presence of chloroform as second phase using bromthymolblue as indicator. Tetrapropylenebenzene is then soluble in chloroform; toluene- and xylenesulfonate in the aqueous phase can be determined by UV-spectrophotometric method. (*In German.*) Zur Bestimmung von Methylbenzolsulfonaten neben Tetrapropylenbenzolsulfonat in flüssigen Waschmitteln. ***E. Heinerth, H. van Raay, and G. Schwarz.*** *Fette, Seifen, Anstrichmittel*, v. 62, no. 9, Sept. 1960, p. 825-832.

*** Identification of Carbonyl Compounds in an Ethanol Extract of Fresh White Bread.** Carbonyl compounds were isolated by the formation of their 2,4-dinitrophenylhydrazone derivatives. ***H. Ng, D. J. Reed, and J. W. Pence.*** *Cereal Chemistry*, v. 37, no. 5, Sept. 1960, p. 638-645.

The Determination of Isotopic Radium. Analytical procedure for the rapid determination of the three naturally occurring alpha-emitting radium isotopes. Concentrations of each of the radium isotopes are determined by selective extraction of the lead and bismuth daughters at suitable times. ***E. J. Baratta and A. C. Herrington.*** *U. S. Atomic Energy Commission, WIN*-118, Sept. 1, 1960, 26 pp. (UF767 Un3.1wi Contin.)

The Coulometric Determination of Hydrazine and Substituted Hydrazines. Rapid, accurate, and automatic coulometric titration procedure for the determination of hydrazine and mono-substituted hydrazines with electrolytically generated bromine. The method has a standard deviation of approximately ± 1%, and is based upon the use of the faraday as a standard. Samples in the 3- to 5-mg. range may be handled readily, and in most cases the procedure can be applied without prior separation of the hydrazine. ***Edward C. Olson.*** *Analytical Chemistry*, v. 32, Nov. 1960, p. 1545-1547.

Thermal Methods of Analysis. Papers presented in the symposium on Thermal Methods of Analysis, Division of Analytical Chemistry, 137th Meeting American Chemical Society, Cleveland, Ohio, April 1960 are given. *Analytical Chemistry*, v. 32, Nov. 1960, p. 1558-1588.

Ion Exchange Separation of Germanium. Procedure utilizes a mixed bed ion exchange column to provide a rapid separation of Ge from most of the ions known to interfere in the photometric determination. Complete determination may be accomplished in less than three hours. ***Thomas R. Cabbell, Allen A. Orr, and John R. Hayes.*** *Analytical Chemistry*, v. 32, Nov. 1960, p. 1602-1603.

a *** Inorganic Circular Paper Chromatography. IV. Separation of the Alkali Metals.** Lithium, sodium, and potassium salts present in a mixture were separated and the individual alkali metals identified, with different solvents using the technique of circular paper chromatography. A mixture of ethyl and methyl alcohols in equal proportions was found to be the best irrigating solvent for a clean and sharp separation of the alkali metals. ***A. R. Vasudeva Murthy and V. A. Narayan.*** *Indian Institute of Science, Journal*, v. 42, no. 3, July 1960, p. 51-55.

b *** Direct Ion-Exchange Chromatography of Tissue Extracts Without Precipitation of Protein by Use of Non-Ionic Detergents.** Method based on the discovery that proteins in the presence of certain polyoxyethylene non-ionic detergents did not adhere to ion-exchange resins but flowed through resin columns directly. ***Robert M. Dowben, Enzo Venturini, Joseph E. Stone, Betty A. Check, and Morris A. Lipton.*** *Biochimica et Biophysica Acta*, v. 43, no. 2, Sept. 23, 1960, p. 338-341.

c *** The Separation and Determination of the Platinum Metals.** Account of the experimental work leading to the development of the method, together with results for the separation of prepared mixtures. ***S. T. Payne.*** *Analyst*, v. 85, Oct. 1960, p. 698-714.

d *** Stoicheiometry of Titration of Calcium, Magnesium and Manganese at Low Concentration With EDTA, With the Metal Indicators Muroxide and Eriochrome Black T.** ***Odd Gjems.*** *Analyst*, v. 85, Oct. 1960, p. 738-744.

e *** Rapid Microanalytical Method for Determining Carbon and Hydrogen in Fluoro-Organic Compounds.** Sodium fluoride was used as the packing material in this method which eliminates the necessity of having to prepare a separate combustion tube, together with the inconvenience of setting up and conditioning that tube each time such a compound is submitted for analysis. ***P. R. Wood.*** *Analyst*, v. 85, Oct. 1960, p. 764-765.

f *** The Determination in Vinyl Esters of Mercury Derived From Mercuric Acetate Catalyst.** Method of direct precipitation and determination of the metal at levels of 1 to 100 ppm in organic solution by means of hydrogen sulfide. ***C. E. Roland Jones and G. E. J. Reynolds.*** *Analyst*, v. 85, Oct. 1960, p. 768-769.

g **A Quantitative Fluorometric Reaction for Glutethimide.** Procedure described for the determination of glutethimide in tablet formulations which is based on the fluorogen resulting from its reaction with concentrated sulfuric acid containing formaldehyde. ***R. P. Haycock, P. B. Sheth, and W. J. Mader.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 49, Oct. 1960, p. 673-677.

h **A Note on the Determination of Boric Oxide by the Modified Wherry's Method.** Errors in the values of boric oxide as determined by Wherry's process may be overcome by neutralizing the alkalinity with hydrochloric acid to a *p*H of about 5.3 prior to the sodium hydroxide/mannitol titration. ***H. Bennett and W. G. Hawley.*** *British Ceramic Society, Transactions*, v. 59, Aug. 1960, p. 315-322.

i **Organic Analysis.** Techniques are described for direct analyses of organic materials. Included are the determination of organic peroxides, specific activities of enzymes, a review of gas chromatography, nuclear magnetic resonance spectroscopy, crystallographic methods for the analysis of crystalline substances using visual microscopy, X-ray diffraction, fusion procedures, and new developments in differential thermal analysis, particularly as they apply to thermal transitions in polymers. ***John Mitchell, Jr., I. M. Kolthoff, E. S. Proskauer, and A. Weissberger.*** v. IV. 429 pp. 1960. Interscience Publishers, Inc., New York. (QD271 Or3 Vis.)

j *** Spectrographic Determination of Ferroalloys. II. Determination of Microamounts of Lead, Copper and Zinc in Ferromanganese. III. Determination of Impurities in Ferrochrome.** A spectrographic method was developed to determine simultaneously microamounts of Pb, Cu, and Zn in ferromanganese, and of Si, Mn, Cu, and Ti in ferrochrome. A calibration method was developed in which a constituent fluctuating in its concentration, such as Mn in ferromanganese, was used as internal standard. Block samples were excited by an intermittent direct current arc, and the effects of the arc current, the arc gap,

the interrupting ratio, and the source voltage were studied. *Yû Yokoyama. Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 12, no. 5, Oct. 1960, p. 423-436.

* **The Turbidimetric Precipitation Titration of Polystyrene.** Turbidimetric precipitation titration of 7 fractions of polystyrene in the molecular weight range 39000 to 740000 and the experimental requirements for reproducibility established. ***A. R. Mathieson.*** *Journal of Colloid Science*, v. 15, no. 5, Oct. 1960, p. 387-401.

* **A Chromatographic Procedure for Separating Chlorpromazine Derivatives.** Descending and circular procedures are described for separating the nine derivatives of chlorpromazine that could result from sulfide oxidation, N-demethylation, or both. The solvent system used was a 3:1:4:2 mixture of dichloroethane, benzene, formic acid, and water. ***Irving B. Eisdorfer and William C. Ellenbogen.*** *Journal of Chromatography*, v. 4, no. 4, Oct. 1960, p. 329-333.

* **Gas Chromatographic Analysis of Incinerator Effluents.** Results indicate that, when the concentration of C_2 hydrocarbons is below 10 ppm, the C_3 to C_5 hydrocarbons are generally present in less than 1 to 2 ppm. When the C_2 hydrocarbons are present in high concentrations, the C_4 to C_6 compounds are generally present in significant concentrations. Some specific C_4 to C_6 compounds found in the effluents from incinerators were identified. ***William N. Tuttle and Milton Feldstein.*** *Air Pollution Control Association, Journal*, v. 10, no. 6, Dec. 1960, p. 427 + 3 pages.

* **The Inframeter: A New Operating Apparatus for Infra-Red Gas Analysis Without Spectral Resolution.** A robust apparatus with positive filtering and self-compensation of the non-selective radiation influences is described, which in addition to good zero and sensitive stability, requires relatively little maintenance, and is well suited for operational measurements. (*In German.*) Das Inframeter: Ein neues Betriebsgerät zur Infrarot-Gasanalyse ohne spektrale Zerlegung. ***Alfred Naumann und Gustav Schulz.*** *Chemie-Ingenieur-Technik*, v. 32, Oct. 1960, p. 669-674.

* **Experience With Capillary Column-Flame Ionization Detector Systems in Gas Chromatography.** An apparatus is described for gas chromatography in which the use of capillary columns gives a better separating efficiency than packed columns. For indication of the components, flame-ionization detectors are employed, having about 10^4 times the sensitvity of thermal conductivity cells. On the basis of the results of measurements, an attempt is made to interpret the tail-formation phenomenon and the dependence of retention volume, and breakthrough times on temperature are discussed. (*In German.*) Erfahrungen mit Kapillarkolonnen-Flammenionisationsdetektor-Systemen bei der Gas-Chromatographie. ***I. Halász and G. Schreyer.*** *Chemie-Ingenieur-Technik*, v. 32, Oct. 1960, p. 675-685.

A Split-Temperature Column System for Gas Chromatographic Analyses. A split-temperature system can be constructed easily and inexpensively with readily available components, and should be usable with most existing gas chromatographs. It permits the analysis of a large number of samples per chromatograph, and permits the use of one single long column for each type of packing. ***Paul Y. Feng and Boguslaw K. Krotoszynski.*** *Nature*, v. 188, Oct. 22, 1960, p. 311-312.

* **Separating Ions in Dissolving and Precipitation Zones on Small Strips of Filter Paper.** A rapid procedure is indicated, and a simple device suitable for the procedure is described. (*In German.*) Ionentrennungen in Auflösungs -und Fallungszonen auf Filtrierpapierstreifen. ***E. Schwarz-Bergkampf.*** *Mikrochimica Acta*, 1960, nos. 5-6, p. 755-757.

* **Ion Separation on a Thread.** Preliminary trials indicate that the sensitivity of separation by solvent extraction may be improved by concentrating the extracts upon a thread. Chromatographic separation may be added to simplify the identification of the metals. ***J. Mahon and A. A. Benedetti-Pichler.*** *Mikrochimica Acta*, 1960, nos. 5-6, p. 831-835.

a * **A Titrimetric Determination of Uranium in Presence of Organic Solvents.** A rapid and accurate volumetric method for the determination of U, Fe, and V in the presence of organic solvents usually employed in solvent extraction processes is described. ***U. Veereswara Rao.*** *Zeitschrift für Analytische Chemie*, v. 177, no. 3, 1960, p. 190-195.

b * **Quantitative Determination of Chlorine Dioxide in Concentrated Solution in the Presence of Chlorine.** The method described permits the use of the tyrosine process. Chlorine interference is prevented for a large part of the concentration by its fixation on monethylamine. Thus better physico-chemical conditions have been obtained for the treatment of potable waters. (*In French.*) Dosage du bioxyde de chlore en solution concentrée en présence de chlore. ***Marcel Lepeintre, Jeanine Dupuy, and Jean Ouvrard.*** *Chimie Analytique*, v. 42, Oct. 1960, p. 498-500.

c * **Determination of Lanthanum by Flame Photometry.** The determination of La by flame photometry was carried out by excitating La by H-O flame and using the band-heads at 560.5 and 442.2 mμ in the spectra of LaO. In the flame photometry, the best result was obtained at 2 lb/in^2 of H pressure and 14∼18 lb/in^2 of O pressure. The emission was the highest in perchloric acid solution. Cerium was found to be tolerated even

d if present in about three times the amount of La. The present method was applied to the determination of La in Fe and steel, and a satisfactory result was obtained. ***Emiko Sudô, Hidehiro Gotô, and Shigerô Ikeda.*** *Tôhoku University, Science Reports of Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 12, no. 5, Oct. 1960, p. 401-406.

e * **Separation and Determination of Rare Earth Elements in Iron and Steel. I. Determination of Cerium and Lanthanum in Iron and Steel. II.** Rare earth elements in Fe and steel were precipitated as fluorides, incinerated to form the oxide, and total amount of the elements was determined. For the determination of Ce, the oxide was dissolved in sulfuric acid, oxidized with persulfate in the presence of $AgNO_3$ to ceric ion, methylene blue was added to the solution, and the

f solution was extracted with benzene in alkaline reaction, the amount being determined by absorbency of the benzene extract. La was determined by flame photometry. ***Shurô Takeyama, Emiko Sudô, and Hidehiro Gotô.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 12, no. 5, Oct. 1960, p. 407-422.

g **Submicro-Methods for the Analysis of Organic Compounds. XII. Determination of Carboxyl Group.** Determination by titration in aqueous alcohol. Direct potentiometric titration is carried out with a modified glass/silver-silver chloride electrode system: a black titration is recommended for the visual method with phenolphthalein as indicator. Samples of ca. 50 μg are titrated in a total volume not exceeding 0·4 ml. with an accuracy of ±1%. ***R. Belcher, L. Serrano-Berges, and T. S. West.*** *Chemical Society, Journal*, 1960, Oct., p. 3830-3834.

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CHEMISTRY—INORGANIC AND GENERAL

i **Dilute Hydrochloric Acid by a Simple Ion Exchange Process.** Acid for muriatic casein can be produced from salt and sulfuric acid. Ion exchanger performance is little affected by changes in the operating variables. ***A. M. Kennedy.*** *Industrial and Engineering Chemistry*, v. 52, Nov. 1960, p. 909-914.

j **Monovalent Zinc.** Evidence for the existence of monovalent zinc in the vapor phase is reported from a series of experiments in which the vapor of divalent zinc halides have been passed over metallic zinc. ***D. H. Kerridge.*** *Chemistry & Industry*, 1960, no. 41, Oct. 8, p. 1266.

k * **On the Co-Precipitation of Microquantities of Germanium by Iron Oxide.** Germanium was in solution in the form of germanic acid, $HGeO_3$ anion and possibly of $Ge_{11}O_{33}$ with trivalent iron hydroxide. It was studied in relation to temperature, time of contact between the precipitate and the

solution, amount of hydroxide introduced, Ge concentration and pH of the solution. (*In Russian.*) O soosazhdenii mikrolichestv germaniia a gidrookis'iu zheleza. ***T. I. Sendul'skaia and M. Ia. Shpirt.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1108-1110.

Anomalous Acceptor Behaviour of Boron Tri-Iodide. Iodide functions as a typical Lewis acid toward trimethylamine and N,N,-dimethylthioformamide in that 1:1 molecular complexes form. The complex from pyridine, however, had the composition $BI_3 \cdot 2C_5H_5N$ and did not have the properties of volatility and organic solubility associated with the molecular complexes. ***E. L. Muetterties.*** *Journal of Inorganic and Nuclear Chemistry*, v. 15, nos. 1-2, Sept. 1960, p. 182-183.

Complexity of Titanium(IV) Fluoride Solutions. Complexity in a constant ionic medium (3 M ClO_4^-) at 25° by means of potentiometric titrations with a quin-hydrone electrode. The complex formation is entirely mononuclear and the highest complex is found to be $TiOF_4^{2-}$. ***V. Caglioti, L. Ciavatta, and A. Liberti.*** *Journal of Inorganic and Nuclear Chemistry*, v. 15, nos. 1-2, Sept. 1960, p. 115-124.

Solvates of Uranium Tetrachloride With Phosphorus Oxychloride. Two compounds of uranium tetrachloride and phosphorus oxychloride, the solvates, $UCl_4 \cdot POCl_3$ and $UCl_4 \cdot POCl_3$, are reported. The tetra-solvate is an aqua-green tetragonal crystalline material with indices of refraction of $n_e = 1.645$, $n_o = 1.657$. The material melts at 340 C (closed tube), following partial liquefaction and resolidification at 118 C. Mono-solvate $UCl_4 \cdot POCl_3$ was light blue-green. Indices of refraction are: maximum index 1.660, minimum index: 1.645. ***R. E. Panzer and J. F. Suttle.*** *Journal of Inorganic and Nuclear Chemistry*, v. 15, nos. 1-2, Sept. 1960, p. 67-70.

Boron Pseudohalides. Preparation of a number of boron isothiocyanates in high yields. ***M. F. Lappert and H. Pyszora.*** *Chemical Society, Proceedings*, 1960, Oct., p. 350-351.

The Preparation, Crystal Structures and Some Properties of Zirconium and Hafnium Dirhenide. The preparation of near stoichiometric zirconium dirhenide, $ZrRe_2$, and hafnium dirhenide, $HfRe_2$, by direct combination of the elements is described. The melting temperature of $ZrRe_2$ was found to be 2750 ± 50° and for $HfRe_2$, 2935 ± 75°. Both compounds have a hexagonal C-14 Laves Structure. These dirhenides are extremely hard, with a DPH of 1400 for each. Both compounds were found to convert to the monocarbides of Hf and Zr in the presence of graphite at about 2150°. ***N. H. Krikorian, W. G. Witteman, and M. G. Bowman.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1517-1519.

*** The Thermodynamic Properties of the Lower Chlorides of Titanium.** Free-energy values determined to within 0.5 kcal per mole, using a "null" method with Hg and Ag as reductants. Attempts to obtain free-energy values failed to give reliable results. Thermodynamic data were obtained by vacuum disproportionation of the trichloride. ***R. B. Head.*** *Australian Journal of Chemistry*, v. 13, no. 3, Aug. 1960, p. 332-340.

The Chemistry of Yttrium and Scandium. Historical development; natural occurrence; atomic characteristics; separation and purification; chemical and physical properties; and analytical procedures. ***R. C. Vickery.*** v. II. 123 pp. Pergamon Press Inc., New York. (QD181.Y7 V66c)

The Equivalent Conductance of the Hexafluorocomplexes of Group IV (Si, Ge, Sn, Ti, Zr, Hf). The limiting equivalent conductance values have been determined for the hexafluorocomplex ions of six elements in Group IV. The K, Rb and Cs salts for each of the fluorocomplexes were prepared and used in determining the value. The plot Λ vs. $C^{1/2}$ yielded the curve of the typical weak electrolyte. ***Robert H. Schmitt, E. L. Grove, and R. D. Brown.*** *American Chemical Society, Journal*, v. 82, Oct. 20, 1960, p. 5292-5295.

Fluorination of Ammonia. The reaction of fluorine and ammonia was reinvestigated in packed copper reactors under varying conditions of stoichiometry. The results qualitatively confirmed the earlier work of Ruff for the reaction in which an excess of F was employed, but in the present study the use of excess ammonia produced dinitrogen tetrafluoride, difluoramine and dinitrogen difluoride in addition to the previously obtained nitrogen trifluoride. A mechanism for the reaction is suggested, which explains the formation of these products and is consistent with previously advanced fluorination mechanisms. ***Scott I. Morrow, Donald D. Perry, Murray S. Cohen, and Carl Schoenfelder.*** *American Chemical Society, Journal*, v. 82, Oct. 20, 1960, p. 5301-5304.

Principles of Phosphorus Chemistry. VII. Reorganization of Polyphosphoryl Halides. Families of phosphoryl and thiophosphoryl halides can be prepared as mixtures by reorganizing various proportions of POX_3, PSX_3, P_2O_5, and P_2S_5. The phosphoryl halides consist of unionized compounds containing one nonbridging O atom fo reach P atom. Thiophosphoryl halides result when some or all of the O atoms are replaced by S. In the reorganized chloride system, S preferentially replaces the nonbridging oxygens. Partial separation of randomly reorganized phosphoryl chloride mixtures was effected by thermal diffusion and vacuum distillation. ***Leo C. D. Groenweghe, John H. Payne, and John R. Van Wazer.*** *American Chemical Society, Journal*, v. 82, Oct. 20, 1960, p. 5305-5311.

*** Complex Sulfates of Tetravalent Plutonium and Alkali Metals.** The following complexes were synthesized: $Na_4Pu(SO_4)_3 \cdot H_2O$, $(NH_4)_6Pu(SO_4)_3 \cdot 2\text{-}4H_2O$, $K_2Pu(SO_4)_3 \cdot 2H_2O$, $Rb_4Pu(SO_4)_4$, $Cs_4Pu \cdot (SO_4)_4$. A definite difference in the absorption spectra between the complex sulfates as well as from the absorption spectrum of plutonium sulfate was shown. (*In Russian.*) Kompleksnye sul'faty chetyrekhvalentnogo plutoniia i shchelochnykh metallov. ***L. V. Lipis, B. G. Pozharskiĭ, M. E. Pozharskaia, and V. V. Fomin.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 10, Oct. 1960, p. 2190-2203.

*** The Composition of the Ions Formed by Hexavalent Molybdenum in the Solutions.** The presence of a large number of different anion forms of hexavalent Mo is the result of the combination of complex valence and intramolecular reaction between the particles formed under these conditions. When Mo is highly concentrated, products varying in weight can be precipitated. Isopolymolybdenum acids must be considered as salts, where Mo plays the part of anion and cation. (*In Russian.*) O sostave ionov, obrazuemykh shestivalentnym molibdenom v rastvorakh. ***Iu. V. Morachevskii and L. I. Lebedeva.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 10, Oct. 1960, p. 2238-2241.

Progress in Inorganic Chemistry. Discusses radioactivation analysis in inorganic geochemistry; halides and oxyhalides of the elements of groups Vb and VIb; extraction of inorganic compounds into organic solvents; some fluorine compounds of the transition metals; intensities of spectral bands in transition metal complexes; unusual oxidation states of some actinide and lanthanide elements; metal alkoxides. ***F. Albert Cotton, editor.*** v. II. 399 pp. 1960. Interscience Publishers, New York. (QD1 P94)

*** Investigations on the Complexes of Palladium (II). Spectra of the Compounds $PdX_2 \cdot 2PR_3$.** New complexes of Pd(II) halides with tri-isopropyl-phosphine have been prepared. The U. V. spectra of these complexes are compared to those of the complexes with tri-ethyl-phosphine. The substitution of *n*-alkyl with *s*-alkyl causes the same type of perturbation which has already been observed in the case of the similar compounds of Ni(II). (*In Italian.*) Ricerche sui complessi di Palladio (II). Spettri dei composti $PdX_2 \cdot 2PR_3$. ***Aldo Turco and Giovanni Giacometti.*** *Ricerca Scientifica*, v. 30, July 1960, p. 1051-1055.

CHEMISTRY—ORGANIC

*** Isolation and Identification of Acetylgalactosamine Monosulfates.** Acetylgalactosamine sulfate was derived from uridine diphospho-*N*-acetylgalactosamine sulfate by mild hydrolysis to acetylgalactosamine-(4)-sulfate. Acetylgalactosamine monosulfates have also been prepared from chondroitin sulfate A, chondroitin sulfate B, and from chondroitin sulfate of shark cartilage. ***Sakaru Suzuki and Jack L. Strominger.*** *Journal of Biological Chemistry*, v. 235, no. 10, Oct. 1960, p. 2768-2770.

• **Degradation of Carbohydrates. I. Isolation of 3-Deoxyhexosones.** Two possible 3-deoxy-D-hexosones were prepared in high yields by the decomposition of diketoseamino acids in dilute aqueous solution at pH 5 and 100 C. Small amounts of the corresponding epimeric aldoses were also isolated. ***E. F. L. J. Anet.*** *Australian Journal of Chemistry*, v. 13, no. 3, Aug. 1960, p. 396-403.

• **Deoxypentose Nucleic Acids. XIV. The Denaturation of Deoxyribonucleic Acid in Aqueous Solution: Properties of DNA Denatured by Dilution. XV. The Sedimentation of Calf Thymus Deoxyribonucleic Acid in 95% Ethanol.** XIV. ***R. B. Inman and D. O. Jordan.*** XV. ***J. H. Coates and D. O. Jordan.*** *Biochimica et Biophysica Acta*, v. 43, no. 2, Sept. 23, 1960, p. 206-222.

• **Cyclizations of Thiocarbohydrazide and Its Mono-Hydrazones. I. Reactions With Orthoesters.** Free thiocarbohydrazide is cyclized by orthoesters to 3-mercapto-4-amino-4,1,2-triazoles, whereas mono-thiocarbohydrazones with the same reagents give the weakly acidic 1,3,4-thiadiazolylhydrazones. ***Jan Sandström.*** *Acta Chemica Scandinavica*, v. 14, no. 5, 1960, p. 1037-1042.

Potential Chemotherapeutics. I. Hydrazine Derivatives, Structurally Related to 1-Benzoxythiocarbo-2-salicylidene Hydrazine. II. 2-(5-Nitro-2-furyl)-5-amino-1,3,4-thiadiazoles. I. ***Kurt Skagius,*** p. 1025-1030; II. ***Kurt Skagius, Kurt Rubinstein, and Else Ifversen,*** p. 1054-1058. *Acta Chemica Scandinavica*, v. 14, no. 5, 1960.

• **The Conversion of Podocarpic Acid to Nimbiol.** Podocarpic acid has been unambiguously converted to nimbiol and nimbiol methyl ether, thus confirming the complete structures assigned to these substances. In the course of this work, a group of C-7 methyl derivatives of podocarpic acid has been prepared. The physical constants of these methyl derivatives are compared with the constants of the parent substances. ***R. H. Bible, Jr.*** *Tetrahedron*, v. 11, nos. 1-2, Sept. 1960, p. 22-29.

• **Molecular Deformation in Cycloöctadecanonaene.** Calculations are reported which show that the large cyclic polyene $C_{18}H_{18}$ recently synthesized cannot possibly be planar as a result of steric forces. The most likely deformation is one of D_{3d} symmetry in which the six inner H atoms suffer displacements of ±0.9 Å perpendicular to the mean plane. The resulting loss of π-electron resonance energy is about 70 kcal/mole. ***C. A. Coulson and A. Golebiewski.*** *Tetrahedron*, v. 11, nos. 1-2, Sept. 1960, p. 125-130.

• **Radiation Oxidation of Lencobases in Ketones in the Absence of Oxygen.** The investigation of the effect of γ-radiation on acetone and on deuteroacetone concludes, that among the initial products of radiolysis the radicals $CH_3\dot{C}O$, CH_3 and $\dot{C}H_2COCH_3$ play the principal role; among them the radical $\dot{C}H_2CO$ can easily complete the oxidation of the type $\dot{C}H_2CO + RH \longrightarrow CH_2CHO + \dot{R}$. (*In Russian.*) Radiatsionnoe okislenie leĭkoosnovaniĭ v ketonakh v otsutstvie kisloroda. ***N. A. Bakh, G. G. Babicheva, and V. A. Larin.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1079-1082.

• **Interaction of Naphthalene With Sulfur.** It is assumed that on passing of vapors of naphthalene and of sulfur through an incandescent iron tube, 1.8 naphthalene disulfide originates. 1.8 Naphthalene disulfide shows distinct positive reactions with the thiophene ring. (*In Russian.*) O vzaimodeĭstvii naftalina s seroĭ. ***N. N. Vorozhtsov jun. and V. Ia. Rodionov.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1085-1086.

• **New Regrouping of Hydrazine Derivatives. Production of β-Dialkylaminopropionitryls From Unsymmetric Dialkylhydrazines and Acrolein.** The infrared spectra of products of condensation of acrolein with dialkylhydrazins confirm their identity with authentic preparations of the corresponding dialkylaminopropionitriles. (*In Russian.*) Novaia peregruppirovka proizvodnykh gidrazina. Poluchenie β-dialkilaminopropionitrilov iz nesimmetrichnykh dialkilgidrazinov i akroleina. ***B. V. Ioffe and K. N. Zelenin.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1094-1097.

a **Chloroboration and Allied Reactions of Olefins.** Demonstration of chloroboration, a new electrophilic-addition reaction of certain olefins. ***F. Joy and M. F. Lappert.*** *Chemical Society, Proceedings*, 1960, Oct., p. 353-354.

b • **Synthese in the Bicyclo-[1.2.2]-heptane-Series. Production of Nortricyclene-Carbonic Acids.** The diene-synthesis of the tiglic acid with cyclopentadiene offers another case of exo-addition. The alcohols obtained from the products of adduction and from those of their hydration by reduction with lithium alanate are described. During the hydrolysis of the adduction products from halide acryl acids and cyclopentadiene, compounds are obtained which lead to two isomeric nortricyclene carbon monoxides. (*In German.*) Synthesen in der Bicyclo-[1.2.2]-heptan-Reihe. Darstellung von Nortricyclen-carbonsäuren. ***Kurt Alder, Rudolf Hartmann, and Wolfgang Roth.*** *Chemische Berichte*, v. 93, no. 10, 1960, p. 2271-2281.

c • **A Contribution to the Reaction of Ketonitriles With Hydrazine Derivatives of Carbon Dioxide.** Acetyl cyanide reacts with compounds of the semicarbazide type in 2 n mineral acid solution into the corresponding hydrazones. The guanyl hydrazone is arranged in a ring with the isomer 1.2.4-trianzine derivative. β-Ketonitrile form pyrazol with hydrazine derivatives of carbon dioxide. With 2-phenyl-thiosemicarbazide, however, only the open-chain hydrazone is produced. (*In German.*) Zur Umsetzung von Ketonitrilen mit Hyrazinderivaten der Kohlensäure. ***Hans Beyer, Theodor Pyl, and Karl-Heinz Wünsch.*** *Chemische Berichte*, v. 93, no. 10, 1960, p. 2209-2216.

d **The Addition Compounds of Cyclic Ethers With Boron Trifluoride.** Stabilities of the addition compounds of cyclic ethers with boron trifluoride were investigated by a manometric method. ***Donald E. McLaughlin, Milton Tamres, and Scott Searles, Jr.*** *American Chemical Society, Journal*, v. 82, Nov. 5, 1960, p. 5621-5625.

e • **Addition of Dialkylphosphorous Acids to 1,5-Naphthylenediisocyanate.** (*In Russian.*) Prisoedinenie dialkilfosforistykh kislot K 1,5-naftilendiizotsianatii. ***E. V. Kuznetsov and M. I. Bakhitov.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 4, Oct. 1960, p. 830-832.

f • **Amination of the Polyhaloderivatives of Benzene.** The obtained results showed that an atom of fluorine is substituted by an aminogroup with a greater velocity than the atoms of chlorine and bromine. This proves to some extent our supposition that the reactions proceed in accordance with the regular bimolecular mechanism. (*In Russian.*) Aminirovanie poligaloidproizvodnykh benzola. ***N. N. Vorozhtsov, Jr., G. G. Iakobson, and T. D. Rubina.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 4, Oct. 1960, p. 821-823.

g **Chlorination of Aromatic Compounds by Antimony Pentachloride.** Chlorination proceeds by electrophilic substitution involving an attacking species of low activity, as evidenced by the almost exclusive *ortho-para* orientation. ***Peter Kovacic and Allen K. Sparks.*** *American Chemical Society, Journal*, v. 82, Nov. 5, 1960, p. 5740-5743.

h **New Heteroaromatic Compounds. VI. Novel Heterocyclic Compounds of Phosphorus.** Heterocyclic analogs of phenanthrene containing N and P in the 9- and 10-positions. ***M. J. S. Dewar and Ved P. Kubba.*** *American Chemical Society, Journal*, v. 82, Nov. 5, 1960, p. 5685-5688.

i **Preparation, Characterization and Physical and Chemical Properties of Tetramethylammonium Ozonide.** Electron paramagnetic resonance measurements showed that the compound is a free radical with one unpaired electron. ***Irvine J. Solomon, Andrew J. Kacmarek, John M. McDonough, and Kiyo Hattori.*** *American Chemical Society, Journal*, v. 82, Nov. 5, 1960, p. 5640-5641.

j • **Complexes in the Series of Aromatic Organo-Zinc Compounds Corresponding to the General Formula ArZnX.** All syntheses and separations of substances were carried out in an atmosphere of an inert gas (nitrogen or argon) and in a medium of dry solvents. The initial zinc-diaryls were produced by a method developed by the authors, through crystalline lithium-

organic compounds. (*In Russian.*) Kompleksy v riadu aromaticheskikh tsinkorganicheskikh soedinenii klassa ArZnX. ***N. I. Sheverdina, L. V. Abramova, and K. A. Kocheshkov.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 4, Oct. 1960, p. 853-855.

* **The Preparation of Substituted Thionocarbamates.** ***A. F. McKay, D. L. Garmaise, G. Y. Paris, S. Gelblum, and R. J. Ranz.*** *Canadian Journal of Chemistry*, v. 38, Nov. 1960, p. 2042-2052.

The Semiconductivity of Organic Substances. VI. A Range of Proteins. Variation of d.c. electrical conductivity with temperature in some 14 proteins and polypeptides in the dry state *in vacuo*. Results are discussed in terms of a model in which the determining process is the penetration of a potential energy barrier by thermally excited electrons. ***D. D. Eley and D. I. Spivey.*** *Faraday Society, Transactions*, v. 56, Oct. 1960, p. 1432-1442.

* **Synthesis of 2-Phenyltropone and Its Bromo-Derivatives From 2-Phenylsuberone.** ***Tadashi Muroi.*** *Chemical Society of Japan, Bulletin*, v. 33, no. 9, Sept. 1960, p. 1166-1170.

* **Oxidation of Terpene Compounds With *tert*-Butyl Chromate. VI. Oxidation of Terpinolene.** Oxidation of terpinolene with *tert*-butyl chromate was carried out. Piperitenone, 8-hydroxy-*p*-cymene, *p*-cymene and α,*p*-dimethylstyrene were obtained as reaction products. ***Tamon Matsuura, Kozo Saito, and Yasuo Shimakawa.*** *Chemical Society of Japan, Bulletin*, v. 33, no. 9, Sept. 1960, p. 1151-1154.

* **Synthesis in the Field of the Nitramines. I. N-Acetoximethylnitramines.** Compounds of the $RN(NO_2)CH_2OOCCH_3$ and $[(CH_3)_n \cdot NNO_2CH_2OOCCH_3]_2$ type were prepared by nitrolysis of the cyclic methylamines $(RNCH_2)_3$ and acetylation of methylol derivatives non-isolated from the primary alcoylnitramines. A N-acetoximethylmethylnitramine was isolated also among the products resulting from the nitrolysis by mixing acetanhydride and nitric acid of the Mannich bases of methylnitramines. (*In French.*) Syntheses dans le domaine des nitramines. I. N-Acetoxymethylnitramines. ***J. Denkstein and V. Kadeřábek.*** *Collection of Czechoslovak Chemical Communications*, v. 25, no. 9, Sept. 1960, p. 2334-2340.

Infrared Spectra of Organic Compounds in the Region 15-35 Microns: Thirteen Organic Oxygen, Nitrogen, Sulfur, and Silicon Compounds. ***C. A. Frenzel, D. W. Scott, and J. P. McCullough.*** *U. S. Bureau of Mines Report of Investigations* 5658, 1960, 17 pp. (TN21 Un3r Room 290)

The Oxidation of *Iso*butane Catalyzed by Hydrogen Bromide. Oxidation in a static system between 125 and 250 C. ***E. R. Allen and C. F. H. Tipper.*** *Royal Society, Proceedings*, v. 258, ser. A, Oct. 18, 1960, p. 251-269.

Propylene Imine Opens New Horizons for the Imaginative Chemist. Reactions of propylene imine fall into two groups: reactions as a secondary amine to yield nitrogen-substituted derivatives in which the imine ring is intact and ring-opening reactions, including polymerization. *Chemical Processing*, v. 23, Nov. 1960, p. 66-67.

* **The Transannular Participation of the Double Bond During the Acetolysis of Cycloheptene-4-yle-p-bromobenzenesulfonate.** This acetoylsis is definitely more rapid than that of the corresponding saturated compounds, and the resulting product is the cis-bicyclo [3:2:1] octyl-2 acetate. (*In French.*) Participation transannulaire de la double liaison lors de l'acétolyse du p-bromobenzènesulfonate de cycloheptène-4 yle. ***Geneviève Le Ny.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 15, Oct. 10, 1960, p. 1526-1528.

* **Synthesis of Two Geometrical Isomers of Hexadeca-2,4,8,10-Tetraenoic Acid and Their *Iso*butylamides.** ***A. Meisters and P. C. Wailes.*** *Australian Journal of Chemistry*, v. 13, no. 3, Aug. 1960, p. 347-356.

* **Benzilic Acid and Related Rearrangements.** Attempts to rationalize a mechanism for the rearrangement in the context of all the pertinent experimental evidence, to rationalize similarly certain closely related reactions, and to correlate these and several other reactions into a general class of base-induced molecular rearrangements. ***Stanley Selman and Jerome F. Eastham.*** *Chemical Society, Quarterly Reviews*, v. 14, no. 3, 1960, p. 221-235.

* **The Reactions of 3- and 5-Bromolaevulic Acid With Thioglycolic Acid.** 3- and 5-isomers of mono-(carboxymethylthio)laevulic acid and the 3:4:4- and 4:4:5-isomers of tris-(carboxymethylthio)valeric acid are prepared from the corresponding isomers of bromolaevulic acid. 3-Bromolaevulic acid is reduced by an excess of thioglycolic acid to 4:4-bis(carboxymethylthio)valeric acid. The carbon-sulfur bond in the 3-substituted thio-ethers is broken by the influence of thioglycolic acid. ***Christoffer Rappe.*** *Arkiv för Kemi*, v. 16, nos. 1-2, p. 171-179.

* **Modifications in Starch and Other Carbohydrates by Means of Thermal Effects.** The average degree of polymerization of potato dry products is between 138 and 170 anhydroglucose units. For pure amylopectin starch, 2000 anhydroglycose units were found; for a cornstarch with 50% amylose, 214; and for a self-manufactured potato starch, 1250. The change in the starch and the other higher molecular carbohydrate components in the manufacture of dry products does not take place through heat effect during the drying process but as early as the steam process. (*In German.*) Veränderungen bei der Stärke und anderen Kohlenhydraten durch thermische Einflüsse. ***W. Diemair and E. Hufnagel.*** *Stärke*, v. 12, Mar. 1960, p. 65-72.

* **Structure and Activity in a Series of 2-Halogenoalkylamines.** ***J. D. P. Graham.*** *Journal of Medicinal and Pharmaceutical Chemistry*, v. 2, no. 5, Oct. 1960, p. 499-522.

Reactivity of Thiobenzophenone With Phenylhydrazine. Thiobenzophenone reacts with phenylhydrazine and with semicarbazide at *p*H 4 about ten times as rapidly as does benzophenone. However, since the reaction of the thio compound is catalyzed by bases, whereas the reaction for the ketone is catalyzed only by acids, the rates differ, at *p*H 6, by a factor of around 2000, and the difference becomes much larger in alkaline solution. Two mechanisms for the processes are discussed. ***John C. Powers and F. H. Westheimer.*** *American Chemical Society, Journal*, v. 82, Oct. 20, 1960, p. 5431-5434.

The Synthesis of the Steroidal Sapogenins. Isoandrosterone (V) is converted by an 18-stage process to a mixture of tigogenin (LXIII) and neotigogenin (LXIV). Each of these steroidal sapogenins is obtained in the pure state and is identified with an authentic sample. The synthesis leads to other steroidal sapogenins (smilagenin, gitogenin, diosgenin, chlorogenin, hecogenin) as well as to certain steroidal alkaloids (tomatidine, solasodine). ***Yehuda Mazur, Naftali Danieli, and Franz Sondheimer.*** *American Chemical Society, Journal*, v. 82, Nov. 20, 1960, p. 5889-5908.

* **Termination in Free Radical Reactions.** Free radicals can react with each other by combination or disproportionation to form stable products. Using statistical and thermodynamic methods, the ratio of the two kinds of reaction can be closely determined. In the liquid phase, the kind of reaction of free radicals is influenced by viscosity and cage effects. Combination and disproportionation are also the most important factors in chain termination in radical chain reactions, such as radical polymerization and oxidation of organic compounds by means of atmospheric oxygen. (*In German.*) Abbruch bei Reaktionen freier Radikale. ***S. J. Lapporte.*** *Angewandte Chemie*, v. 72, no. 21, Nov. 7, 1960, p. 759-766.

International Series of Monographs on Organic Chemistry. Homolytic Aromatic Substitution. Theoretical aspects of the homolytic substitution reactions, their preparative use, and ample references to the original literature and to review articles are included when these are available. ***G. H. Williams.*** v. IV. 133 pp. 1960. Pergamon Press, New York. (QD331 W67h)

* **Tetronic Acids.** ***L. J. Haynes and J. R. Plimmer.*** *Chemical Society, Quarterly Reviews*, v. 14, no. 3, 1960, p. 292-315.

The Scope of Organotin Compounds in Industry. New fields of application are accessible to tin through recent researches into the synthesis and properties of organic compounds of this metal. Some of these substances are powerful fungicides

which are finding use in the protection of crops, wood, textiles, paper, and paint against attack by fungi and other pests. ***Ernest S. Hedges.*** *Research Applied in Industry*, v. 13, Nov. 1960, p. 449-452.

* **Florida Coldpressed Murcott Oil.** The chemical and physical characteristics of cold-pressed Murcott oil expressed by the FMC-In-Line extractor are presented. These data show Murcott oil to have characteristics similar to those for tangerine oil. ***J. W. Kesterson and R. Hendrickson.*** *American Perfumer*, v. 75, Nov. 1960, p. 35-37.

Polycyclic Hydrocarbons in Crude Peat Wax. Further separation of the second major fraction and the isolation and characterization of a polycyclic hydrocarbon. ***Margaret R. Gilliland, A. J. Howard, and D. Hamer.*** *Chemistry & Industry*, 1960, no. 44, Oct. 29, p. 1357-1358.

* **Recent Results in Total Synthesis of Steroids.** A tricyclic compound was synthesized from 6-methoxy-a-tetralon as a starting material for all syntheses. This tricyclic compound possesses the five-membered D-ring, but not the angular 19-methyl group. A characteristic feature of this new synthesis is that a racemic carboxylic acid is resolved in an early stage of the synthesis and the formation of an A-ring is facilitated by condensation with 1.3-dichloro-butene-(2). The condensation product shows the antitrans configuration of natural steroids. (*In German.*) Neuere Ergebnisse bei der Totalsynthese von Steroiden. ***L. Velluz, G. Nominé, and J. Mathieu.*** *Angewandte Chemie*, v. 72, nos. 19-20, Oct. 7, 1960, p. 725-730.

* **Reaction of Phosphites With Azo Compounds.** Trialkyl phosphites react vigorously with azo compounds containing negative substitutes in the azo group such as CO_2R, COSR, SO_2Ar and $C_6H_2(NO_2)_3$, and also with phenyl diazonium fluoboride or double salts of phenyl diazonium chloride and of $HgCl_2$. In different cases addition compounds of phosphites or decomposition of the azo compounds are obtained. (*In Russian.*) Reaktsiia fosfitov s azosoedineniiami. ***V. A. Ginsburg, M. N. Vasil'eva, S. S. Dubov, and A. Ia. Iakubovich.*** *Zhurnal Obscheĭ Khimii*, v. 30, no. 9, Sept. 1960, p. 2854-2863.

* **Investigations of Pyrazoles. VIII. Synthesis of Furylpyrazoles. IX. A New Method to Synthesize Pyrazole Carbonic Acids. X. Reaction of Pyrazole With Mercury Salts. XI. The Alkylation of Pyrazoles.** (*In Russian.*) Issledovanie pirazolov. VIII. Sintez furilpirazolov. IX. Novyĭ metod sinteza pirazolkarbonovykh kislot. X. Vzaimodeĭstvie pirazolov s soliami rtuti. XI. Ob alkilirovanii pirazolov. VIII. ***I. I. Grandberg, A. N. Kost, and D. V. Sibiriakova.*** IX. ***A. P. Terent'ev, I. I. Grandberg, D. V. Sibiriakova, and A. N. Kost.*** X. ***I. I. Grandberg, A. N. Kost, and N. N. Zheltikova.*** XI. ***I. I. Grandberg and A. N. Kost.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 9, Sept. 1960, p. 2920-2946.

* **Phosphorus-Containing Polyester and Polyamide Resins.** Previously unreported bis(*n*-carboxyphenyl)-phosphinic acid, its esters, salts, amide and acid chloride were obtained, as well as phosphororganic polyesters and polyamide on the basis of ethylene glycol, diethylene glycol and bis(*n*-carboxyphenyl)-phosphinic acid. (*In Russian.*) Fosforsoderzhashchie poliefirnye i poliamidnye smoly. ***K. A. Petrov, V. A. Parshina, and G. L. Daruze.*** *Zhurnal Obshcheĭ Khimii*, v. 30, no. 9, Sept. 1960, p. 3000-3004.

Technique of Organic Chemistry. v. I, Pt. III. Physical Methods of Organic Chemistry. Spectrometry in the visible and ultraviolet, absorption spectrophotometry, miscellaneous ultraviolet and Raman spectra, photographic plates for spectroscopy, and some applications of spectroscopy to organic chemistry are discussed. ***Arnold Weissberger, editor.*** 3rd Ed. 836 pp. 1960. Interscience Publishers, Inc., New York. (QD453 W44p3)

* **Acylation of Silanes and Synthesis of Silicon-Containing a-Methylstyrenes.** A previously developed method of acylation of aromatic silicon hydrocarbons was improved so as to produce the corresponding ketones with yields up to 70%. Benzyl trimethyl silane is acylated about 24 times, and β-phenyl ethyl trimethyl silane only 16 times more rapidly than benzene, which is explained by the conjugation of the Si-C bond and of the aromatic ring in benzyl trimethyl silane. (*In Russian.*) Atsilirovanie kremneuglevodorodov i sintez kremnesoderzhashchikh

a-metilstirolov. ***E. A. Chernyshev, E. N. Kliukina, and A. D. Petrov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 9, Sept., p. 1601-1606.

Synthesis of Some Vicinal Trimethoxyphenyl Derivatives of Heterocyclic Nitrogen Bases. A number of vicinal trimethoxy analogs of compounds possessing psychopharmacological activity were synthesized to examine their influence on this type of activity. ***F. Benington, R. D. Morin, and L. C. Clark, Jr.*** *Journal of Organic Chemistry*, v. 25, Nov. 1960, p. 1912-1916.

Mescaline Analogs. X. 3,4-Dimethyl-, 3,4-Dichloro-, and 3,5-Dimethoxy-4-methyl-β-phenethylamines. In a study of the influence of ring substituents of β-phenethylamines on psychopharmacological activity, three new β-phenethylamines substituted in the 3-, 4-, or 5-positions of the ring were synthesized, and the effect of these compounds on normal cat behavior was examined. ***F. Benington, R. D. Morin, and Leland C. Clark, Jr.*** *Journal of Organic Chemistry*, v. 25, Nov. 1960, p. 2066-2067.

Metallo-Organic Compounds Containing Metal-Nitrogen Bonds. I. Some Dialkylamino-Derivatives of Titanium and Zirconium. Compounds were prepared either by treating the metal chloride with the appropriate lithium dialkylamide or by aminolysis involving a tetrakisdialkylamino-metal compound and another dialkylamine. ***D. C. Bradley and I. M. Thomas.*** *Chemical Society, Journal*, 1960, Oct., p. 3857-3861.

Organic Chemistry of Bivalent Sulfur. Cyclic sulfides; thials and thiones; sulfide-acids; methionine; mercaptals and mercaptoles; mercaptals and mercaptoles of the sugar group; disulfides and polysulfides. ***E. Emmet Reid.*** v. III. 486 pp. 1960. Chemical Publishing Co., Inc., New York. (QD412.S1 R27o)

CHEMISTRY—PHYSICAL

* **The Influence of Temperature on the Protolytic Equilibriums and Reaction-Rate Constants of Basic Triphenylmethane Dyes.** Protolytic reaction scheme examined for methyl green at 40 C and 60 C. Dissociation, hydration, and reaction-rate constants were determined at 20, 40, and 60 C. ***Rune Cigén.*** *Acta Chemica Scandinavica*, v. 14, no. 5, 1960, p. 979-993.

* **The Ion Exchange Properties of Silica Gel. I. The Sorption of Na^+, Ca^{2+}, Ba^{2+}, UO_2^{2+}, Gd^{3+}, Zr(IV) + Nb, U(IV) and Pu(IV). II. Separation of Plutonium and Fission Products From Irradiated Uranium.** ***Sten Ahrland, Ingmar Grenthe, and Bertil Norén.*** *Acta Chemica Scandinavica*, v. 14, no. 5, 1960, p. 1059-1090.

* **The Crystal Structure of the Copper(II) Salicylaldehyd Ethylendiimine Complex.** In the lattice, the molecules are conjugated to double molecules. There is a deformation of the molecules being planar per se: the combining forces between the complex centers produce an approach to these centers to 3.2 Å, accompanied by a bending of the individual molecule planes. (*In German.*) Die Kristallstruktur des Kupfer(II)-Salicylaldehydäthylendiimin-Komplexes. ***K. Pachler and M. v. Stackelberg.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 305, nos. 5-6, Aug. 1960, p. 286-290.

The Crystallography of the Biscyclic Dibenzacridines. I. The Electron Distribution in 1.2:8.9-Dibenzacridine. The crystal and molecular structure of the above has been determined by a least-squares refinement of the complete two-dimensional X-ray data. The average estimated standard deviations of the C-C and C-H bond lengths are 0.009 and 0.08 Å, respectively, the mean C-H bond length in the molecule being 1.08 Å. The observed "difference" density and bond lengths are compared with predictions based on molecular-orbital theory. ***R. Mason.*** *Royal Society, Proceedings*, v. 258, ser. A, Oct. 25, 1960, p. 302-318.

Solubility of Xenon in Liquid Bismuth. ***A. M. Eshaya and W. F. Kenney.*** *U. S. Atomic Energy Commission, BNL-617* (T-186), Jan. 1959, 4 pp. (UF767 Un3.1bn Contin.)

Thermodynamics of Some Oxides of Molybdenum and Tungsten. New low-temperature heat-capacity data leading to the evaluation of the 298.15 K entropies of tungsten dioxide and tungsten trioxide, as well as high-temperature heat contents of molybdenum dioxide, molybdenum trioxide, tungsten dioxide, and tungsten trioxide. ***E. G. King, W. W. Weller, and A. U. Christensen.*** *U. S. Bureau of Mines Report of Investigations* 5664, 1960, 29 pp. (TN21 Un3r Room 290)

* **The Temperature of Boron Combustion.** A method was developed to determine this temperature with no auxiliary fuels. A process, consisting of weighing the initial boron oxide and the solid products after combustion, was found to determine the amount of boron oxide formed during combustion. For the standard enthalpy of formation of a vitreous oxide from crystalline B_2O_3 and gaseous O_2, a value of $\Delta^{H}form^{B_2O_3}glass = -298.7 \pm 1.8$ kcal/mol was obtained. (*In Russian.*) Teplota goreniia bora. ***G. L. Gal'chenko, A. N. Kornilov, and S. M. Skuratov.*** *Zhurnal Neorganicheskoĭ Khimii,* v. 5, no. 10, Oct. 1960, p. 2141-2147.

* **Potential Constants of Ethylene Oxide, Ethylene Oxide-d_4 and Ethylene Sulphide.** ***K. Venkateswarlu and G. Thyagarajan.*** *Indian Academy of Sciences, Proceedings,* v. 52, sec. A, no. 3, Sept. 1960, p. 101-108.

* **Determination of the Nitrogen-Isotope Frequency in Ammonia-Nitrogen.** Directives are given for the transformation of NH_3-N into elementary N_2, the N form suitable for the mass spectrometric determination of the frequency involved. Special attention is paid to the possibilities of errors and to the falsification of results by foreign gases. Corrective formulas for the calculation of the vacuum needed for the chemical preparation are obtained. The reproducibility of determination is about 0.2 or 0.03%. (*In German.*) Die Bestimmung der Stickstoff-Isotopenhäufigkeit im Ammonia-kstickstoff. ***R. Hüser, K. Habfast, and M. v. Bradke.*** *Zeitschrift für Analytische Chemie,* v. 176, no. 6, p. 429-436.

Some Problems in the Spectroscopy of Complex Molecules. It is shown that the fundamental spectroscopic manifestations of complex molecules can be understood from a single viewpoint. In connection with this, the general problem is stated. Possible explanations are given of the origin of absorption continua in the spectra of complex molecules. It is shown that the applicability of the oscillator approximation to complex molecules permits the explanation of the experimentally observed temperature dependence of band intensities. ***S. I. Kubarev.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 1-3.

Effect of Foreign Gases on the Intensity of the Electronic Absorption of 3-Dimethylamino-6-Aminophthalimide Vapor. A study was made of the effect of a large group of different foreign gases (monatomic He, Ne, A, Kr, Xe, diatomic H_2, D_2, N_2, O_2, CO, NO, triatomic H_2O, D_2O, and polyatomic NH_3, C_2H_4, C_3H_8, C_5H_8, C_4H_{10}, C_6H_{12}) on the intensity of the electronic absorption spectrum of 3-dimethylamino-6-aminophthalimide vapor. ***S. O. Mirumyants and B. S. Neporent.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 4-7.

The Influence of Impurities on the Luminescence of Crystalline Naphthalene. The influence of temperature and impurity concentration on the luminescence and absorption spectra of solutions of β-methylnaphthalene, α-methylnaphthalene, β-naphthol, and α-naphthol in crystalline naphthalene was investigated. A number of effects were discovered, showing that molecules of β- and α-methylnaphthalene, and also β- and α-naphthol, form two types of luminescence centers when they are introduced into the crystalline lattice of naphthalene. ***M. T. Shpak and E. F. Sheka.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 29-32.

Calorimetric Determination of the Heat of Adsorption of Oxygen on Evaporated Films of Germanium and Silicon. The heats of adsorption of O_2 on evaporated films of Ge and of Si were determined to an absolute accuracy of ± 5 % by means of a Beeck type calorimeter. The variation of the heat of adsorption with surface coverage was studied, together with the simultaneous change in film resistance. The significance of the results is discussed. ***D. Brennan, D. O. Hayward, and B. M. W. Trapnell.*** *Physics and Chemistry of Solids,* v. 14, July 1960, p. 117-123.

* **Calculation of the Adiabatic Absorption of Hydrochloric Acid Gas.** The adiabatic absorption method is a simplification of the absorption of HCl-containing gases diluted by water vapor and inerts. The absorption was explained by means of an enthalpy-concentration diagram combined with a boiling diagram. The acid concentration was derived very simply from a McCabe Thiele diagram. The relationships in an absorber can be calculated on the basis of quantity and energy balance values. (*In German.*) Die Berechnung der adiabatischen Absorption chlorwasserstoffhaltiger Gase. ***Reiner Vieweg.*** *Chemische Technik,* v. 12, no. 9, Sept. 1960, p. 525-531.

* **Spectrophotometry Study of Titanyl-Hydrogen-Peroxide-Fluoride System.** The addition of hydrogen peroxide to an acid solution of titanyl ion in the hydrogen ion concentration range where this ion is not hydrolized forms a mononuclear complex $[TiO\ H_2O_2]^{++}$: its formation constant has been determined at a constant ionic medium ($3M = ClO_4^-$) by spectrophotometry: $lg\ \beta = 3.51 \pm 0.02\ M^{-1}$. (*In Italian.*) Studio spettrofotometrico del sistema titanile-acqua ossigenatafluoruro. ***Liberato Ciavatta and Arnaldo Liberti.*** *Ricerca Scientifica,* v. 30, Aug. 1960, p. 1186-1197.

* **Mechanism of Crystallization of Colloidal Titanium Dioxide.** The change in interfacial tension between the colloid particle and intermicellar liquid by changing the composition of the latter has no considerable effect on the crystallization of colloidal titanium dioxide. The presence of water in the system significantly affects the crystallization process. (*In Russian.*) O mekhanizme kristallizatsii kolloidnoĭ dvuokisi titana. ***Z. Ia. Berestneva, M. B. Konstantinopol'skaia, and V. A. Kargin.*** *Kolloidnyĭ Zhurnal,* v. 22, no. 5, Sept.-Oct. 1960, p. 557-559.

* **Radiation Reduction of Trivalent Iron Ions in Solutions Saturated With Hydrogen Under Pressure.** In degassed sulfuric acid solutions, the Fe^{3+} ion does not undergo conversions under the effect of radiation because the total of the oxidizing components $G_{OH} + 2G_{H_2O_2}$ is greater than the amount of the reducing component - G_H; the H_2, which forms up on radiolysis passes over into the gaseous phase not participate in reactions. Therefore, the investigation of the kinetic characteristics of the Fe^{3+} ion was carried out in systems which contained different additions. (*In Russian.*) Radiatsionnoe vosstanovlenie ionov trekhvalentnogo zheleza v rastvorakh, nasyshchennykh vodorodom davleniem. ***V. N. Shubin and P. I. Dolin.*** *Akademiia Nauk SSSR, Doklady,* v. 134, no. 4, Oct. 1960, p. 891-894.

Catalysis on Metals of Group 8. V. The Kinetics of the Hydrogenation of Cyclopropane and of Methylcyclopropane. ***G. C. Bond and J. Newham.*** *Faraday Society, Transactions,* v. 56, Oct. 1960, p. 1501-1514.

The Heat of Formation of the Hypochlorite Ion. The heat of formation was redetermined calorimetrically at 25° by measuring the heat of hydrolysis of chlorine in basic solutions. The value obtained was $\Delta H^O = -26.2 \pm 0.1$ kcal/mole. The entropy was calculated to be 8.6 ± 0.3 e.u. ***J. E. McDonald, J. P. King, and J. W. Cobble.*** *Journal of Physical Chemistry,* v. 64, Oct. 1960, p. 1345-1346.

Thorium Tartrate Complexes by Polarimetry. Optical rotation changes can be used to follow the formation of complexes between tartrate and Th(IV). The greatest rotation change in acid solutions is given by a species with one tartrate per thorium, found at *p*H 3-3.5. Two tartrates per thorium on the average are required through the whole *p*H range to keep the thorium in solution. ***Leonard I. Katzin and Elsie Gulyas.*** *Journal of Physical Chemistry,* v. 64, Oct. 1960, p. 1347-1350.

The Kinetics of the Reactions of Aromatic Hydrocarbons in Sulfuric Acid. I. Benzene. The rate of sulfonation of benzene in sulfuric acid solution was measured spectrophotometrically. An empirical equation has been found which fits the experimental results and which can be interpreted in terms of the concentration of the molecular sulfuric acid present in mixtures of sulfuric acid and water. ***Martin Kilpatrick, Max W. Meyer, and Mary L. Kilpatrick.*** *Journal of Physical Chemistry,* v. 64, Oct. 1960, p. 1433-1435.

Free Radical Lifetimes in Radiation-Induced Reactions. The Addition of *n*-Butyl Mercaptan to Octene-1. Free radical lifetime measured by a modification of the rotating sector technique. ***William H. Clingman, Jr.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1355-1359.

Intermolecular Effects in Solutions of Methyl Isobutyl Ketone in Alcohols and Fluoroalcohols. Comparison of the dielectric constants of mixtures of methyl isobutyl ketone and each of the alcohols, $CF_3 \cdot CH_2OH$, $HCF_2 \cdot CF_2 \cdot CH_2OH$, $HCF_2 \cdot (CF_2)_3CH_2OH$ with mixtures of methyl isobutyl ketone and their corresponding hydrogen analogs. ***Hartley C. Eckstrom, Jerry E. Berger, and Lyle R. Dawson.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1458-1461.

The Heat of Formation of Potassium Fluoroborate. Value obtained for the enthalpy of formation was -451.6 ± 0.6 kcal/mole. ***James L. Bills and F. Albert Cotton.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1477-1479.

Radiation Chemistry of Cyclopentane-Cyclohexane Mixtures. Radiolysis of mixtures of cyclopentane and cyclohexane with γ-rays at 70,000 rads/hr results in a greater yield of products derived from cyclopentane than would be expected from the fraction of this component in the system. This effect is attributed to a change in the identity of the intermediate radicals as a result of preferential abstraction of H from the cyclopentane. Studies of the primary radical yields by iodine scavenging methods and of the effect of intensity on the products from the mixed hydrocarbons confirm this explanation. ***G. A. Muccini and Robert H. Schuler.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1436-1438.

Uranium Hexafluoride: A Survey of the Physico-Chemical Properties. Handbook compiled in an attempt to collect all of the current physico-chemical data on UF_6 in one useful volume and to highlight apparently contradictory results. ***R. DeWitt.*** *U. S. Atomic Energy Commission, GAT-280*, Aug. 12, 1960, 164 pp. (UF767 Un3.1ga Contin.)

Experimental and Theoretical Determinations of Bond Lengths in Naphthalene, Anthracene and Other Hydrocarbons. Determinations by X-ray crystallography of the C-C bond lengths in naphthalene and anthracene. ***D. W. J. Cruickshank and R. A. Sparks.*** *Royal Society, Proceedings*, v. 258, ser. A, Oct. 18, 1960, p. 270-285.

Some Refinements in the Correlations of the Raman Spectra With Molecular Structures for Acyclic Mono-Olefinic Hydrocarbons. Raman spectra of a large number of olefins, recorded with the Cary Model 81 photoelectric recording spectrometer, are examined. Particular attention is paid to the symmetric deformation band of CH_3 groups attached to the double bond and to carbon atoms alpha to it, as well as to the properties of the C=C stretching band itself. ***D. G. Rea.*** *Analytical Chemistry*, v. 32, Nov. 1960, p. 1638-1651.

* **Infrared Spectrum and Structure of Tetramethyl Ammonium Chloride.** The IR spectrum of $(CH_3)_4NCl$ was measured between 2.5 and 50μ with prism spectrographs. The frequencies of absorption are ascribed to the different fundamental vibrations, assuming that the ion $(CH_3)_4N^+$, considered alone, has a tetrahedral structure corresponding to the group of T_d points. (*In French.*) Spectre infrarouge et structure du chlorure de tétraméthylammonium. ***Vincenzo Lorenzelli and Karl Dieter Möller.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 15, Oct. 10, 1960, p. 1483-1484.

* **Chemisorption of Gases on Metals.** Review concerned with the interaction of gases, such as H_2, O_2, N, CO with W, Ni, Pt, Pd, and Cu. ***P. M. Gundry and F. C. Tompkins.*** *Chemical Society, Quarterly Reviews*, v. 14, no. 3, 1960, p. 257-291.

Polarography of Organic Halogen Compounds. I. Steric Hindrance and the Half-Wave Potential in Alicyclic and Aliphatic Halides. Alkyl and cycloalkyl bromides yield well-defined waves at the dropping mercury electrode with tetraethylammonium bromide as the supporting electrolyte in N,N-dimethylformamide. ***Frank L. Lambert and Kunio Kobayashi.*** *American Chemical Society, Journal*, v. 82, Oct. 20, 1960, p. 5324-5328.

Chronopotentiometric Studies on the Oxidation of Ferrocene, Ruthenocene, Osmocene and Some of Their Derivatives. Oxidation-reduction potentials obtained by chronopotentiometric methods at a Pt electrode in an acetonitrile solution indicate electron withdrawing substituents decrease the ease of oxidation, while electron donating substituents increase the ease of oxidation with respect to the parent metallocenes. This is in accord with the results normally expected from inductive effects. The $E_{1/4}$ values of ferrocene and its derivatives have been correlated with the substituent constants of the Ingold-Taft equation. Ruthenocene has been observed to undergo a one-step, two-electron oxidation while osmocene undergoes a two-step, one-electron each, oxidation. ***Theodore Kuwana, Donald E. Bublitz, and George Hoh.*** *American Chemical Society, Journal*, v. 82, Nov. 20, 1960, p. 5811-5817.

Nitric Acid Oxidation Rates for Selected Coals and Related Substances. Routine method for the determination of fusain. ***J. B. Gayle and A. G. Smelley.*** *U. S. Bureau of Mines Report of Investigations* 5654, 1960, 12 pp. (TN21 Un3r Room 290)

* **Modification of Starch by Means of Ionizing Rays. III. Wheat and Cornstarch.** Wheat and cornstarch were treated with 3,000,000 rep of γ-rays. Like potato starch, the viscosity decreases with increasing irradiation, the solutions become more acid, and the binding power for iodine decreases. Solutions of cereal starches can be separated into a sol and gel phase by electrodialysis treatment. (*In German.*) Veränderung der Stärke unter dem Einfluss ionisierender Strahlen. III. Mitteilung. Weizen- und Maisstärke. ***M. Samec.*** *Stärke*, v. 12, Apr. 1960, p. 99-102.

The Photolysis of Methyl Mercaptan. The effects of time, pressure and temperature on the photolysis of methyl mercaptan have been investigated. At low conversions, H_2 is the only important uncondensable gas. Methane arises from secondary reactions involving the product. Hydrogen results exclusively from the breaking of the S-H bond. The decompositon of CH_3S requires at least 30 kcal. $mole^{-1}$. ***T. Inaba and B. deB. Darwent.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1431-1433.

* **Some Iodine Derivatives of Dibenzoselenophene.** An investigation was organized to explain the effects of the halogen on the absorption in the near ultraviolet exhibited by dibenzoselenophene and on the orientation toward the electron-seeking reaction. The study was restricted to 2 iododibenzoselenophene and the corresponding mononitro-derivative 2-iodo-8-nitro-dibenzoselenophene, obtained by nitration of 2 iododibenzoselenofene. (*In Italian.*) Alcuni jododerivati del dibenzoselenofene. ***Nunziata Marziano.*** *Ricerca Scientifica*, v. 30, May 1960, p. 743-745.

* **Effect of the Substituents Nature Near the Silicon Atom on the Frequency of Total-Symmetrical Stretching Mode of Si-C in the Spectra of Silico-Organic Compounds.** The functional relationship between the nature of the radical, characterized by its effective electric negativity, and the frequency of the valent fully symmetrical vibration of Si-C was determined. The relationship found permits a quantitative evaluation of the character of the interamolecular reaction of the Si atom with its radicals. (*In Rusisan.*) Vliianie prirody zamestiteleĭ u atoma kremniia na chastotu valentnogo polnosimmetrichnogo kolebaniia Si-C v spektrakh kremneorganicheskikh soedineniĭ. ***Iu. P. Egorov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 9, Sept., p. 1553-1560.

* **Catalytic Dehydration of α-Isobutyltetrahydrofurane.** During the dehydration of this compound on a titanium-aluminous catalyst at 400 C, at a 20-30 mm pressure and a volume speed of 0.25 to 0.30 $hour^{-1}$, a catalyzate was obtained containing in fractions boiling out between 121.7 and 128 C up to 95% diene hydrocarbons. Together with the dehydration mentioned, a redistribution of H among the products of reaction occurred, resulting in the formation of the alkene C_7-C_8. (*In Russian.*) Kataliticheskaia degidratatsiia α-izobutiltetragidrofurana. ***N. I. Shuikin and G. K. Vasilevskaia.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1960, no. 9, Sept., p. 1664-1667.

The Thermodynamics of Chromium Diboride. Thermal capacities of CrB_2 are cited. Entropies of Cr, B, CrB, are given. ***A. N. Krestnikov and M. S. Vendrik.*** *Henry Brutcher Translation No.* 4914, 6 pp. (From *Izvest. VUZ - Chern. Met.*, March 1960, No. 3, pp. 13-16). Henry Brutcher, Altadena, Calif.

* **Relationship Between the Sublimation Heat of the Elements and Their Position in the Periodic System.** A curve of the periodicity of the change of the standard temperature of sublimation at 298 K with a change of the ordinal number of the element was drawn. (*In Rusisan.*) O sootnoshenii mezhdu teplotoĭ sublimatsii elementov i ih polozheniem v periodicheskoĭ sisteme. ***N. Nesmeianov and N. E. Khandamirova.*** *Moscow, Universitet, Vestnik, Seriia II, Khimiia*, v. 15, no. 4, July-Aug. 1960, p. 28-32.

The Effects of X-Ray and Gamma Ray Irradiation on the Thermal Decomposition of Ammonium Perchlorate in the Solid State. Shows that several stages of reaction are involved in the decomposition of ammonium perchlorate and that the low-temperature stages are appreciably enhanced as a result of pre-irradiation. The relative importance of the stages of reaction were found to be a function of the exposure dose. Suggests that the increased reactivity of the irradiated substance may be due to the presence of positive holes which would favor an electron transfer mechanism of decomposition. ***Eli S. Freeman, David A. Anderson, and Joseph J. Campisi.*** *Journal of Physical Chemistry*, v. 64, Nov. 1960, p. 1727-1732.

COATINGS

Phenolic and Alkyd Media for Water-Thinnable Stoving Paints. ***J. R. Berry.*** *Paint Technology*, v. 24, Oct. 1960, p. 16 + 4 pages.

The Commercial Production of Isophthalic Acid Alkyd Resins. *American Paint Journal*, v. 45, Nov. 1, 1960, p. 8 + 16 pages.

* **Silicone Rubber for Roller Coating.** Describes silicone rubber-covered rollers, as used for various industrial coating processes, particularly in the plastics field. ***R. A. Gardner.*** *Rubber and Plastics Age*, v. 41, Oct. 1960, p. 1249-1251.

* **Protective Coatings for Corrosion Control in Production Operations.** Performances of 15 systems are evaluated. ***R. M. Robinson.*** *Journal of Petroleum Technology*, v. 12, Oct. 1960, p. 20-24.

New Glass-Coated Metal for High Temperature Equipment. Concerns a new process for ceramic coating of metals resulting in composite of a polycrystalline glass, a base metal, and a strong diffusion bond between them. *Materials in Design Engineering*, v. 52, Oct. 1960, p. 9-10.

A Study of Pigmented Coatings for Application to Fiber Glass Products. *American Paint Journal*, v. 45, Nov. 3, 1960, p. 8 + 3 pages.

* **The Salt Spray Test.** The existing standards are surveyed, and 22 independent variables are discussed which govern the results of the tests. Today, the salt spray test is only regarded as suitable for determining coarse flaws in coatings, and for comparing the performance of materials which are not too different from each other, e.g. surface-treated aluminum alloys. (*In German.*) *Die Salzsprühprobe.* ***A. Kutzelnigg.*** *Werkstoffe und Korrosion*, v. 11, Sept. 1960, p. 547-551.

* **Manufacture of Felt-Based Linoleum Tiles.** A general description. ***O. V. Soane.*** *Fibres and Plastics*, v. 21, Oct. 1960, p. 295-297.

* **The Enamelling of Ferrous Metals.** The raw materials essential to the different types of fabrication, the metal-carriers and their surface preparation, enameling techniques in connection with steel and cast iron, and dry and liquid enameling were studied. (*In French.*) L'émaillage des métaux ferreux. ***P. Tyvaert.*** *Corrosion et Anticorrosion*, v. 8, no. 9, Sept. 1960, p. 319-331.

* **The Effect of Driers on Drying Times of Clear and Pigmented Alkyd Resins.** Effects of Co, Mn, and lead naphthenate additions on the drying patterns of linseed oil-modified glycerol phthalate alkyd resins were studied. ***Leopold Dintenfass.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Oct. 1960, p. 709-719.

* **Penetration of Varnishes and Inks Into Paper Under Pressure.** ***R. R. Coupe and Baysung Hsu.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Oct. 1960, p. 720-736.

* **Vapour Deposition of Metals With Particular Reference to Nickel Plating by Thermolysis of Nickel Carbonyl.** Can be used to deposit thick coatings onto reactive bases, such as Mg or U, or onto porous metal compacts. Design and operation of low pressure and atmospheric pressure nickel carbonyl plating plant. ***L. W. Owen.*** *Institute of Metal Finishing, Transactions*, v. 37, pt. 3, Autumn 1960, p. 104-107.

Carbon Black Dispersions. Survey of carbon black in dispersed form commencing with a review of its uses. ***P. Lowe.*** *Paint Manufacture*, v. 30, Oct. 1960, p. 349-352.

* **Synthetic Resins. V. Fluorocarbon Resins.** ***Harold P. Preuss.*** *Metal Finishing*, v. 58, Oct. 1960, p. 62 + 4 pages.

Preparation of Nonionic Emulsions of Polyethylene Wax. Suitable nonionic surfactants system and pressure method of processing can produce, on a fairly consistent basis, satisfactory wax emulsions of low color. ***M. O. Brunson and L. D. Queen.*** *Soap and Chemical Specialties*, v. 36, Oct. 1960, p. 82-84.

* **Printing Inks Under the Food Additives Amendment.** ***Einar T. Wulfsberg.*** *American Pressman*, v. 70, no. 10, Oct. 1960, p. 6 + 3 pages.

* **Anti-Stick Coating Finds New Application.** Use of polytetrafluoroethylene. *Industrial Finishing (London)*, v. 12, Oct. 1960, p. 42-43.

The Protection of Iron and Steel by Aluminium Coatings. Processes for coating Fe and steel with Al are discussed with special reference to metal spraying and hot-dip of aluminizing, and to calorizing, which is used where resistance to scaling at high temperatures is required. An indication is given of the structure and properties of each type of coating. ***D. R. Andrews.*** *Metallurgia*, v. 62, Oct. 1960, p. 153-158.

* **Strippable Protectives.** Surveys protective, anti-corrosive coatings which can be used to protect castings and provide a transparent packaging. ***E. S. Lower.*** *Industrial Finishing (London)*, v. 12, Oct. 1960, p. 46-48.

Properties of Materials—Finishes and Coatings. Electrodeposited coatings; hot-dip coatings; diffusion coatings; organic coatings; ceramic, cermet, and refractory coatings; suppliers' literature. *Materials in Design Engineering*, v. 52, no. 6, Mid-Nov. 1960, p. 329-347.

* **Developments in Coatings.** Diepoxides for the surface coatings industry, modern nitrocellulose furniture finishes, a melamine-acrylic water-soluble resin system for industrial finishes, trimethylolpropane applications in alkyd resins, and polyesters for surface coatings are discussed. *Chemistry in Canada*, v. 12, Nov. 1960, p. 27-47.

* **Hot Dip Aluminised Steel Sheet.** The production of hot dip aluminized steel is an important technical development. Properties of aluminized steel of particular interest to the corrosion engineer are discussed. ***John H. Nicholls.*** *Corrosion Prevention & Control*, v. 7, Oct. 1960, p. 42-45.

* **Properties and Processing of Ethylene Copolymers for Wire and Cable.** In accelerated weathering and outdoor exposure tests copolymers containing carbon black are as stable as branched polyethylenes. The ethylene copolymers are exceptional in resistance to environmental stress cracking. ***D. J. Vaughan and W. W. Spohn.*** *Wire and Wire Products*, v. 35, Oct. 1960, p. 1323 + 3 pages.

* **The Application of Enamel Coverings to Rectangular Copper Sections and Their Specialised Application in the Manufacture of Continuously Transposed Conductors.** A detailed discussion. ***J. F. Cowen.*** *Wire and Wire Products*, v. 35, Oct. 1960, p. 1347 + 4 pages.

* **Science for the Coatings Technologist. XVI. Dispersion Continued: Individual Mills.** Theory of closed mill performance; other factors of closed mill operation; high-speed stone mills. ***E. S. Beck.*** *Metal Finishing*, v. 58, Dec. 1960, p. 48-52.

* **Synthetic Resins—The Backbone of Modern Finishes. VI. Epoxy Resins (Section A).** A survey of the latest developments in synthetic resins used in coatings. ***Harold P. Preuss.*** *Metal Finishing*, v. 58, Dec. 1960, p. 56-60.

Etching Steel for Adherence of Porcelain Enamel. Special steel chemistry and processing are required to produce sheets satisfactory for one finish coat porcelain enameling. Etching of non-fishscaling, non-boiling steels in the enameling plant followed by Ni flashing is necessary for good adherence. This combination insures improved single coat enamelware. ***F. W. Beall, R. L. Myers, and J. J. Canfield.*** *American Ceramic Society Bulletin*, v. 39, Dec. 1960, p. 727-731.

* **Knowledge of Cellulose Triacetate for Use as a Raw Material in Varnishes and Plastics. Possibility of Combining Cellulose Triacetate With Resins. V.** Systematic investigation have shown that cellulose triacetate can be combined with essentially differently synthetized resins than secondary acetate and acetobutyrate. Nevertheless, there are important restrictions with reference to solvents and plasticizers for cellulose triacetate. The formation of a lacquer coating using straight or partial cellulose triacetate is complicated by the vigorous force of solvation characteristic of solvents for triacetate. (*In German.*) Zur Kenntnis des Zellulosetriazetats als Lack- und Plastrohstoff V. Über die Kombinierbarkeit des Zellulosetriazetats mit Harzen. ***K. Thinius and W. Thümmler.*** *Plaste und Kautschuk*, v. 7, Oct. 1960, p. 486-488.

Urethane Coatings Aim High for New Jobs. At the Paint Industries Show a new quick-drying urethane coating vehicle, Spenkel F78, was introduced. Urethane coatings have moved from the specialty finish field into broad marketing. *Chemical Week*, v. 87, no. 19, Nov. 5, 1960, p. 27 + 3 pages.

* **Application of Electrical Insulation by the Fluidized-Bed Process.** Advantages and limitations of the new fluidized-bed process for applying insulation to electrical and electronic components and equipments are discussed. Design parameters, economics and practical applications for the process are explored and developed. ***Max M. Lee.*** *Electro-Technology*, v. 66, no. 4, Oct. 1960, p. 149-153.

* **Engineering Factors in Coating With Silicone Rubber for High Temperatures.** Coating glass cloth. ***H. I. Silversher and Fred Olster.*** *Rubber Age*, v. 88, no. 2, Nov. 1960, p. 297-302.

* **Molybdate Pigments: New Corrosion Inhibitors.** A study was made of calcium and zinc molybdates to determine their corrosion inhibiting properties. In some instances these pigments, either alone or with a topcoat, exhibited anti-corrosion properties which equalled or exceeded those of red lead under the test conditions. Suggestions for possible uses of these materials are given. ***Helmuth O. Schoen and Benson G. Brand.*** *Official Digest*, v. 32, Nov. 1960, p. 1522-1543.

* **A Study of Factors Affecting Rusting of Steel and Blistering of Organic Metal Coatings.** Determinations of water and O permeability, water absorption, water extractibles, variations of osmotic pressure and adhesion were made on unpigmented coating vehicles for steel in attempting to correlate these with rates of blistering of these films and rates of rusting during water immersion. ***William Wettach.*** *Official Digest*, v. 32, Nov. 1960, p. 1463-1476.

* **Zinc Coatings on Iron and Steel. 7—Tests and Specifications. A Survey.** The life of a Zn coating is roughly proportional to its weight and independent of the method of application, and while the incorporation of small amounts of common impurities in Zn had no recognizable effect, uniformity of thickness, or the lack of it, had a marked effect on the life of the coating. ***A. K. Parker.*** *Metal Finishing Journal*, v. 6, no. 70, Oct. 1960, p. 393 + 4 pages.

* **Flame Spraying of Aluminium Oxide.** Rod type and powder-type flame-spray guns were used. The particle-impact process is not well understood. ***Dwight G. Moore.*** *Metal Finishing Journal*, v. 6, no. 70, Oct. 1960, p. 397-403.

* **Flame Spraying of Aluminum Oxide.** With alumina as a model substance, the basic processes encountered with the spraying of ceramic powders were studied; viz. the melting process in the flame jet, the composition, lattice structure and physical properties of the spray coating, and the adhesion of the latter on pure metals and alloys with different surface roughness conditions. (*In German.*) Über das Flammspritzen von Aluminiumoxyd. ***H. Meyer.*** *Werkstoffe und Korrosion*, v. 11, Oct. 1960, p. 601-616.

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

* **Orthogonal Codes.** Code alphabets whose characters can be represented by a finite sequence of digits of value +1 or −1 have been extensively investigated. The characters of these binary codes may be considered to be superpositions of orthogonal functions, one for each digit, which are multiplied by +1 or −1. A character of an orthogonal code consists of one function of a set of orthogonal functions multiplied by +1 or −1. ***H. F. Harmuth.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 242-248.

* **Regulating Behavior and Controllability of Typical Controlled Plants.** Deals with the possibilities of influencing the transfer characteristics of the controlled plants. The term "controllability" is then studied and, in this connection, an attempt is made to classify the most important types of regulating behavior of the controlled plants falling into the field of application under consideration. (*In German.*) Stellverhalten und Regelbarkeit typischer Regelstrecken. ***P. Profos.*** *Regelungstechnik*, v. 8, no. 10, Oct. 1960, p. 335-340.

* **Optimum Performance of Two-Step Action Controllers With Feedback.** Maximum permissible deviation in balanced condition becomes the criterion for the limits of application of on-off controllers. The improved control by means of delayed or delayed reset feedback is explained by examples with an analogue computer. Instructions for adjustment enable direct setting of the controller in compliance with the transient function of the plant. (*In German.*) Optimales Verhalten von Zweipunktreglern mit Rückführung. ***W. Böttcher.*** *Regelungstechnik*, v. 8, no. 10, Oct. 1960, p. 340-344.

* **A Calculation of Switching Functions as a Means of Minimizing Error in an On-Off Control System.** Self-optimization of control systems is becoming practical because of new developments in the electronics field, notably in digital-computer techniques. This paper proposes an adaptive switching function as an on-off controller. Results are given for repeated application of step and ramp inputs to a mathematical model of an ideal servo mechanism, set up on a Deuce digital computer. The results neglect relay imperfections, they are preliminary in nature, and intended to provoke further research. ***R. F. Brown.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 249-256.

* **Some Methods for Simulating Cybernetic Systems From Their Normal Operating Records.** Methods involving the use of a differential analyzer (analog digital or hybrid) are proposed. The methods are based upon ideas similar to the principles of the interpolative method, and possess simplicity of calculations in comparison with the well-known methods of the determination of dynamic characteristics of systems from normal operating records. (*In Ukrainian.*) Deiaki metody modeliuvannia kibernetychnykh system za danymy yikh normal'noyi roboty. ***V. T. Kulik.*** *Avtomatyka*, 1960, no. 3, p. 17-30.

Analog Computer for Charged Particle Trajectories. The electrical circuit involved employs analogs for both quadrupole magnets and bending magnets, and thus it facilitates the determination of both the focal properties and the dispersion characteristics of the magnets; an accuracy as good at 2% has been attained for some of the calculations made with the present instrument. ***Robert H. Good and Oreste Piccioni.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1035-1039.

* **Determination of the Pulsating Load of Electrical Machines by Means of the Electronic Analog Computer.** Determination of the transition behavior and of the pulsating loads

involved of the asynchronous and synchronous machine during the action of shock-like external disturbances by copying the two machines mentioned on the electronic analog computer. The rapid acceleration of the asynchronous machine at direct switching on and the dynamic behavior of a loaded synchronous motor at voltage drops in the feeding system during the changing-over of the main system as examples taken from the practice. (*In German.*) Ermittlung der Stossbeanspruchung elektrischer Maschinen auf dem elektronischen Analogrechner. ***Ludwig Hannakam.*** *Stahl und Eisen*, v. 80, no. 21, Oct. 13, 1960, p. 1389-1397.

New Memory Devices Highlight Research Trends. NEREM papers spotlight recent progress in space and ocean electronics, information technology, and microminiaturization. ***Thomas Maguire, editor.*** *Electronics*, v. 33, no. 46, Nov. 11, 1960, p. 73-77.

Progress in Process Instrumentation. The slow rate of development of automatic control in the process industries is analyzed. Expresses fear that computer control may follow a similar path. *Industrial Chemist*, v. 36, Nov. 1960, p. 562-564.

* **Application of Process Dynamics to Process Control.** Fundamental data required for analysis of control loops are discussed and the control characteristics of a stirred tank liquid heater and a simple distillation column are fully described, thus illustrating the importance of a knowledge of the dynamic characteristics of chemical plant. ***W. D. Armstrong.*** *Chemical & Process Engineering*, v. 41, Nov. 1960, p. 487 + 3 pages.

* **Digital Computing Machines.** The milestones in the development of computing machines are: ENIAC (Electronic Numerical Integrator and Computer), the first electronic computing machine; EDVAC (Electronic Discrete Variable Automatic Computer), the first internally stored program computing machine—the first acoustic delay-line storage; MADM (Manchester Automatic Digital Machine), first index registers (B-lines)—first cathode-ray tube electrostatic storage; MTC (Memory Test Computer), first core-storage computing machine. ***Alice Mary Hilton.*** *Electro-Technology*, v. 66, no. 4, Oct. 1960, p. 164-185.

* **CORSAIR—A Digital Differential Analyser.** In CORSAIR the state of each integrator is described by means of two numbers or words in binary code which are stored in a ferrite core matrix. These number pairs are read out sequentially and integration process takes place in a central time-sharing arithmetic unit. ***P. L. Owen, M. F. Partridge, and T. R. H. Sizer.*** *Electronic Engineering*, v. 32, Dec. 1960, p. 740-745.

* **A VLF Function Generator.** A method of synthesizing a repetitive time function with 100 "steps" or 100 "ramps" is described. The frequency range is 0.025 to 15 c/s and variations of the output function are less than 0.5%. ***L. Whitlow.*** *Electronic Engineering*, v. 32, Dec. 1960, p. 750-752.

ELECTRICAL ENGINEERING

A Simple Field Detector for a DC Permeameter. A two-core flux-gate magnetometer is employed in a simple balanced bridge circuit as the dc field detector of a single strip permeameter. The sensitive magnetometer and simple bridge circuit eliminated the necessity of the complex filter and selective amplifier used in earlier systems and allows operation independent of oscillator frequency stability. The H-measuring system is designed to measure fields from 1 moe to about 10 oe with a sensitivity of $\approx$ 25 μa/moe. Economy and simplicity of construction, circuitry, and operation are its chief advantages. ***Charles Q. Adams.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1119-1120.

* **The Characteristics of the Trigatron Spark-Gap at Very High Voltages.** Curves are given showing the working range and time-lag characteristics of a trigatron spark-gap working in air at voltages up to 1 MV. It is shown that, for voltages of this magnitude, a single-stage trigatron spark-gap of suitable design provides a simple and convenient method of chopping

the voltage at any required instant. Factors which affect the performance of the gap are discussed. ***T. E. Broadbent.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 213-215.

* **Electric and Magnetic Images.** The method of images as applied to electrostatic, magnetostatic and electromagnetic fields is investigated. By considering the uniqueness of the field it is shown within what limits the method can safely be used, and rules are given for its use. The application of the method is illustrated by a discussion of the electric field near a cylindrical cathode and the magnetic fields near the end-windings of electrical machines. ***P. Hammond.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 306-313.

* **The Stabilization of Control Systems With Backlash Using a High-Frequency On-Off Loop.** The technique described employs an auxiliary loop to drive the motor across the backlash whenever the motor and load tend to separate. Requirements of the auxiliary loop are deduced and a phase-plane analysis is developed for a second-order position-control system with this loop operative. Analysis shows that the system with backlash is effectively linearized. It is also shown that impacts between motor and load are avoided. ***E. A. Freeman.*** *Institution of Electrical Engineers, Proceeding*, v. 107, pt. C, no. 12, Sept. 1960, p. 150-157.

* **Voltage and Current Transformation Matrices.** Transformation matrices relating two adequate systems of simple network co-ordinates such as node-pair voltages or link currents belong to the class of unimodular or E-matrices. Since the loop- and cut-set-to-branch incidence matrices are closely related to transformation matrices, the discussion proposes new sets of necessary conditons for incidence matrices corresponding to systems of node-pair voltages or link currents. Examples are given of matrices which, while representing a voltage transformation, cannot represent a current transformation and vice versa. Another example shows an E-matrix which can represent neither a voltage nor a current transformation. ***I. Cederbaum.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 145-149.

* **Spectrum of the Signal Subjected to Frequency Transformation.** A method to determine the frequency of combination vibrations in the frequency transformation when the vibrations of the transformed signal have a spectrum with a fixed width is described. The analysis is carried out by means of a system of four double inequalities and its graphic representation on two network nomographs. (*In Russian.*) O spektre signala, podvergaiushchegosia chastotnomu preobrazovaniiu. ***B. A. Khanov.*** *Elektrosviaz'*, v. 14, no. 10, Oct. 1960, p. 14-20.

* **The Application of Signal-Flow Diagrams to Interconnected Electric Power Systems.** An interconnected electric-power system represented by two areas coupled by a controlled tie-line is analyzed with the aid of the signal-flow diagram. The areas are time-error governed while the tie controllers are of the integral type. ***D. Broadbent and H. R. Chinn.*** *Australian Journal of Applied Science*, v. 2, no. 3, Sept. 1960, p. 353-359.

Resistance Anisotropy at Low Temperatures. Gives a theoretical treatment, based on the variational principal, for the thermal conductivity tensor of dielectrics at low temperatures, where N-processes predominate. The general expression is developed in the case where U-processes are the only ones not conserving wave number, and the ratio of components of the conductivity tensor at very low temperatures is here shown to depend only on the geometry of the lattice unit cell. The results are applied to different crystal structures, and a satisfactory comparison is made with the somewhat meager available experimental data on quartz and sapphire. ***S. Simons.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 458-464.

A Phenomenological Theory of the Characteristic Energy Losses of Fast Electrons in Metals. Derivations are made for a target metal having an optical absorption band of similar energy to the free electron plasma frequency. Relative positions of the band and plasma frequency are considered and it is shown that the presence of an optical band introduces further particle absorption levels and may shift in either direction or completely screen out the plasma line. The theory agrees with the general experimental picture, and predicts certain results

which had hitherto been unsatisfactorily accounted for, but the lack of information concerning optical absorption bands in the relevant energy region precludes any detailed comparison for a particular metal. ***C. B. Wilson.*** *Physical Society, Proceedings,* v. 76, pt. 4, Oct. 1960, p. 481-488.

Density of a Thorium Monolayer for Maximum Thermionic Emission. Describes an investigation in which a high-sensitvity analytical balance of standard design is used for determination of the surface density of that Th layer which corresponds to maximum thermionic emission with the Th-on-W system. Following Brattain and Becker's definition of this value of surface density as one "*f* unit", Th vapor is allowed to accumulate on a quartz plate until a weighable number of *f* units (about 600) is deposited. The Th flux in *f* units per minute is monitored periodically by means of a W filament diode during the course of the deposition. ***W. E. Danforth and D. L. Goldwater.*** *Journal of Applied Physics,* v. 31, Oct. 1960, p. 1715-1717.

Static Magnetic Frequency Multipliers. Multiplying the frequency of an a-c power source by the use of saturating magnetic components is an old technique, but efficiency of a new order is possible with the newer sharply saturating materials, and new rectifiers for systems employing d-c for core saturation. Multiplier operation based on both a-c and d-c saturation is related to examples of the important variations of the principle. ***Gordon M. Bell.*** *Electro-Technology,* v. 66, no. 5, Nov. 1960, p. 94-102.

* **A Kilovolt, Kiloampere Low Pressure Switch.** A low pressure switch is described that is capable of passing kiloamperes at voltages up to 30 kV. The effect of pressure and gap voltage on the switch closing time is discussed. ***George J. Brucker and Kenneth C. Rogers.*** *Nuclear Instruments and Methods,* v. 8, Aug. 1960, p. 236-238.

* **Pulse Type Frequency Modulation Discriminators.** The advantages of a system having parameters more developed than those of usual detectors, the defects, and the field of application were examined. The absence of oscillatory circuits simplifies the assembling, adjustment and operation. Low distortion is obtained by means of an intermediate frequency lower than 300 to 600 kc. (*In Russian.*) Ob impul'snykh chastotnykh detektorakh. ***V. L. Rychka.*** *Radiotekhnika,* v. 15, no. 10, Oct. 1960, p. 51-59.

* **Aircraft Storage Batteries.** Some characteristics of lead-acid, Ni-Cd, and Ag-Zn aircraft batteries were presented. Many advantages of each system were emphasized and certain disadvantages mentioned. Efforts are needed to improve cycle life charge retention, charge acceptance, and low-temperature performance. More research is needed to find ways to increase H overvoltage on Pb, Cd, and Zn. ***Walter J. Hamer.*** *Applications and Industry,* 1960, no. 50, Sept., p. 277-287.

* **Adjustable Frequency Drives With Rotating Machine Power Supply.** Basic features of adjustable frequency systems, motor performance, effect of line-voltage drop on pull-in torque of synchronous motors, power-supply characteristics, starting methods, draw control methods are discussed. ***A. T. Bacheler and C. G. Helmick.*** *Applications and Industry,* 1960, no. 50, Sept., p. 254-260.

* **The Model-TWM 2 Automatic Teleprinter Switching System for the Western Union Telegraph Company.** Setup of a TWM 2 exchange, design features, functions, and mode of operation of the common electronic coder and its orbit of application are discussed. ***Hermann Rädler.*** *Siemens Review,* v. 27, no. 9, Oct. 1960, p. 286-290.

* **A New Electrical Form of Discharge Which Was Obtained by the Superposition of Two Different Discharges.** By superimposing a DC or an intermittent current on a high-frequency torch form of discharge, a new form of discharge was obtained, whose properties depend not only on the parameters of the torch, but also on the superimposed current. As a spectrum source, this type of discharge offers a multitude of excitation possibilities. (*In German.*) Eine neue elektrische Entladungsform, die durch Überlagerung zweier verschiedenartiger Entladungen erhalten wurde. ***G. D. Cristescu.*** *Annalen der Physik,* v. 6, nos. 3-4, Sept. 1960, p. 153-155.

* **Digital Computer Applied to the Design of Salient-Pole Synchronous Machines.** The input data should be kept to an absolute minimum, even at the expense of operating time, which in any case is the shortest part of the chain of events. Although the design methods which have been programed are the exact methods used in current practice, it is not intended to use the program for final designs. ***G. K. Ridley.*** *Engineer,* v. 210, Oct. 28, 1960, p. 705-710.

ELECTROCHEMISTRY

Irreversible Thermodynamics in Electrochemistry. The application of the Onsager thermodynamics to electrochemical systems out of equilibrium permits a unified approach to the problems of concentration cells with transference, thermal diffusion in electrolytes, initial and final emf's of thermal cells. For isothermal concentration cells, the method confirms the classical results of Nernst derived from equilibrium considerations of free energy. For non-isothermal systems, the method brings out the entropy S transported from hot to cold heat reservoirs (in the limit of equal temperatures), multiplied by the applied temperature differential dT, as the characteristic thermodynamic driving force of a process. ***Andre J. deBethune.*** *Electrochemical Society, Journal,* v. 107, Oct. 1960, p. 829-842.

Entropy of the Moving Cuprous Ion in Molten Cuprous Chloride From Thermogalvanic Potentials. Potentiometric measurements have been made on a thermogalvanic cell consisting of Cu electrodes immersed in molten cuprous chloride in which there was a temperature gradient. The difference in temperature ΔT between the electrodes was varied from 30 to 70 C and the average temperature of cell Tavg was varied from 462 to 588 C. Over these ranges the emf was proportional to ΔT, and $\Delta E/\Delta T = -0.436$ mv/°C, the hot electrode being the (-) terminal of the cell. From this value, the entropy of the moving cuprous ion in the melt was calculated for three different temperatures. ***Ambrose R. Nichols, Jr. and Cecil T. Langford.*** *Electrochemical Society, Journal,* v. 107, Oct. 1960, p. 842-847.

Fused Salt Polarography Using a Dropping Bismuth Cathode. An apparatus is described which is suitable to study fused chlorides by the polarographic technique. Dropping Bi is used in a way analogous to dropping Hg. Polarographic waves are shown for $PbCl_2$, $ZnCl_2$, and $CdCl_2$ in a LiCl-KCl eutectic melt at 450 C. The method serves as an analytical tool at high temperatures, besides yielding physicochemical information such as diffusion coefficients by application of the Ilkovic equation. ***Raymond J. Heus and James J. Egan.*** *Electrochemical Society, Journal,* v. 107, Oct. 1960, p. 824-828.

Handbook of Electrochemical Constants. Topics discussed are fundamental constants and properties of irons, salts, and solvents; numerical values of some functions used in the theory of electrolytes; activity coefficients; thermodynamic properties of HCl and NaOH; thermal properties of electrolytes; equilibrium constants in solution; molal volumes of electrolytes and their temperature and pressure dependence; molten salts; equilibrium properties of electrodes; viscosity and diffusion in electrolytes; conductivity of electrolytes; kinetic properties of electrodes; and surface tension, dielectric constant, and refractivity. ***Roger Parsons, compiler.*** 113 pp. 1959. Butterworths Scientific Publications, London. (QD553 P25h)

* **The Electro-Chemical Fuel Cell: Stage of Development and Possibilities of Application for Driving Motor Vehicles.** History of development and report on latest experimental progress, with definition of fuel cells according to the valence electronics theory—cells for solid, liquid and gaseous fuels, with chemical reactions—H and O cells—the use of fuel cells in motor vehicles—advantages and disadvantages—practical tests with an agricultural tractor in the USA. (*In German.*) Die elektrochemische Brennstoff-Zelle. Entwicklungsstand und Möglichkeiten zum Antrieb von Fahrzeugen. ***W. Steinhilper.*** *ATZ Automobiltechnische Zeitschrift,* v. 62, Oct. 1960, p. 273-276.

Catalytic Activity and Electronic Structure of Rhodium-Palladium-Hydrogen Cathodes in Acid Solution. Hydrogen overvoltage measurements were made on a series of Rh-Pd alloy cathode beads. Two phases, α and β similar to those in the

Pd-H system, are considered in the Rh-Pd-H system. Mechanisms for the H producing reactions on Rh, Pd, and Rh-Pd alloy cathodes are discussed. From low current density measurements the catalytic activity of the cathode surface for the H reaction was determined. It appears that vacancies in the *d*-band of the catalyst metal are necessary for strong bonds between the absorbed H and the surface but it is the density of states at the Fermi level that determines how strong the chemisorbed bonds are. The catalytic activity is directly related to the heat of absorption and so to the *d*-band structure. ***James P. Hoare.*** *Electrochemical Society, Journal*, v. 107, Oct. 1960, p. 820-824.

* **Structure of Cryolitic Baths for the Electrolysis of Aluminum in Solid, Liquid and Vapor Phases.** Measures of vapor tensions in form of a liquid-vapor equilibrium diagram as well as measures of chemical compositions and molecular weights of the vapors of a series of molten mixtures composed by AlF_3 and NaF are described. The ions Na^+ F- and AlF_4^-, are predominant in the molten cryolitic bath, while the vapor is mostly formed by $NaAlF_4$ molecules, at least in the zone of practical interest in the industrial electrolysis. (*In Italian.*) Tensione di vapore dei bagni criolitici struttura dei bagni criolitici allo stato solido liquido di vapore. ***A. Vajna and R. Bacchiega.*** *Metallurgia Italiana*, v. 52, Aug. 1960, p. 481-494.

* **Electrolytic Deposition of Manganese.** Describes the electrochemical and technological problems, concerning the electrolytic deposition of Mn and the deriving conditions of electrolysis. Reports the conditions obtained during a running period of one year in a pilot plant, producing 100 kg of metal daily. (*In Italian.*) La deposizione elettrolitica del manganese. ***G. Scacciati.*** *Metallurgia Italiana*, v. 52, Aug. 1960, p. 551-560.

* **Effects of Electrochemical Treatment on the Mechanical Properties of Steels.** During Zn plating in non-cyanogen electrolytes, the change of the mechanical properties of steel is considerably lower than during Zn plating in cyanogen electrolytes. During the electrolytic Cd deposition and Cu deposition from cyanogen solutions, Sn and Pb deposition from acid solution, the mechanical properties of steel change to a lesser extent than during Zn deposition from a cyanogen electrolyte. The lowest mechanical properties are observed during chromium plating. (*In Russian.*) Vliianie elektrokhimicheskoĭ obrabotki na mekhanicheskie svoistva staleĭ. ***N. T. Kudriavtsev and I. I. Moroz.*** *Metallovedenie i Termicheskaia Obrabotka Metallov*, 1960, no. 10, Oct., p. 36-40 + 2 plates.

* **Barrel Plating Solutions.** Gives solution recipes for plating brass, bronze, Cd, Cr, Cu, Au, Fe, Pb, Ni. Rh, Ag, Sn, and Zn. ***F. J. La Manna.*** *Metal Finishing*, v. 58, Oct. 1960, p. 66-70.

* **Stress in Electrodeposited Metals.** Measurements of residual stress; effect of stress on properties and uses of electrodeposits; stresses in Cu and Cr. ***I. Laird Newell.*** *Metal Finishing*, v. 58, Oct. 1960, p. 56-61.

The Influence of Pre-Plating Processes on the Porosity of Electrodeposits on Steel. The electrochemical method of obtaining a numerical index of the porosity of electrodeposits, previously described by the authors, was applied to a study of the effects of pre-plating preparation of steel. Five different rolled steels and coatings of Ni, Sn-Ni, Sn and speculum were examined. The validity of the test method has been verified by comparison with laboratory and exposure tests yielding visual indications of porosity. It was found that the depth of steel removed by any method of pre-plating preparation had an influence on the porosity of the coating sufficiently large to obscure, if it were not controlled, effects of difference in preparation method. The removal of the extreme surface layer of steel (about 0.00001 in.) influences the porosity of the applied coating for better or worse according to the metal deposited and the conditions of deposition. Evidence was obtained that this effect depends on the form of crystal growth of the deposit. With deeper uniform penetration into the steel, zones were reached which were apparently features of the steel and influenced porosity almost independently of the character of the deposit. These zones are attributed to bands of nonmetallic inclusions. The observed effect of depth of penetration helps to explain the divergent results previously obtained in investigations of surface preparation. It suggests that, in practice, when controlled penetration cannot be expected, no method of surface preparation will give consistent porosity of deposits on a range of steels. The response of an undercoating to the condition of the steel surface was found to govern the porosity of a composite coating. Well-chosen undercoatings may therefore offer the best method of obtaining consistent results and of reducing porosity. ***M. Clarke and S. C. Britton.*** *Institute of Metal Finishing, Transactions*, v. 37, pt. 3, Autumn 1960, p. 110-120.

The Structural Stability of Tin-Nickel Electrodeposits. Metallographic and X-ray examination of tin-nickel electrodeposits has shown that, in the as-plated condition, they are single-phase with a nickel arsenide type of crystal structure. These deposits are structurally stable at temperatures up to at least 500 C, but at 700 C and above, decomposition into a mixture of two phases, Ni_3Sn_2 and Ni_3Sn_4, takes place. ***R. F. Smart and D. A. Robins.*** *Institute of Metal Finishing, Transactions*, v. 37, pt. 3, Autumn 1960, p. 108-109.

* **The Influence of Brightening Agents on the Electrolytic Deposition of Iron-Chromium-Nickel Alloys.** In this type of deposition, the brightening effect of organic and inorganic brightening agents is much smaller than with the deposition of each of these metals on their own. This lessening of the brightening effect is attributable to the fact that the chromium hydroxide diaphragm formed on the cathode surface interferes with the formation of the adsorption film of the brightening agent. The current yield of the alloy deposition is even more reduced if the brightening agent is able to bring about, at the same time, a noticeable improvement in the gloss. (*In German.*) Über den Einfluss von Glanzbildnern auf die elektrolytische Abscheid-ung von Eisen-Chrom-Nickel-Legierungen. ***Willi Machu and M. F. M. El-Ghandour.*** *Werkstoffe und Korrosion*, v. 11, Oct. 1960, p. 628-631.

* **Anodizing Copper, Magnesium, Zinc, Cadmium, Steel and Silver.** The anodizing process and solutions for each metal and its alloys are discussed in detail. ***N. P. Fedot'ev and S. Ya. Grilikhes.*** *Electroplating and Metal Finishing*, v. 13, Nov. 1960, p. 413-417.

* **Studies on Electrolytic Refining of Zinc. VII. Effects of Manganese on Corrosion of Lead Anodes.** Effects of Mn on corrosion of a 1% silver-lead alloy anode were estimated by comparing results of experiments with and without Mn in amounts up to 8 g/l at various temperatures and current densities. Manganese, even in very small amount, acts favorably to prevent disintegration of the anode by depositing on it as a scale, and results in decreasing Pb in the anode slime. However, excessive scale of manganese dioxide tends to break away from the anode and causes a sudden increase in the anode slime, and in consequence, the Pb content of the deposited Zn. Thus, the electrolyte containing a relatively small amount of Mn is preferable with respect to stabilities of the oxide film and the anode potential. ***Seitaro Fukushima.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 12, no. 5, Oct. 1960, p. 456-468.

The Charge Distribution at the Zinc Oxide-Electrolyte Interface. Capacitance measurements made on single-crystal ZnO electrodes in contact with aqueous electrolytes are reported. Results are in almost quantitative accord with predictions of the simple Poisson-Boltzmann equation. This implies the complete absence of surface-state effects in this system. ***J. F. Dewald.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 155-161.

ELECTRONICS

* **A Low-Power Cathode for Television Picture Tubes.** Cathode diameter is 0.050 in., thickness 0.011 in., and rated power 0.21 w. Assembly is made by forming a W coil to a flat spiral, embedding it in alundum, coating with Ni powder which is then sintered, and finally coating with the usual alkaline earth carbonates. Tests results show it to be rugged mechanically, operable over a range of 1.2 to 1.6 v., and to have a heating time for stable operation of 10 sec. Tubes employing this cathode are in production. ***H. E. Smithgall.*** *Sylvania Technologist*, v. 13, no. 4, Oct. 1960, p. 118-121.

* **A Theory of Steady Forces in Variable-Parameter Networks. Applicable to a Class of Square-Law Measuring Instruments.** Passive linear reciprocal networks with elements

dependent upon a generalized co-ordinate x are investigated in order to evaluate the steady component of the corresponding generalized force $(F_x)_{av}$. Methods are found for expressing this force in terms of parameters measurable at the input terminals of the network. The analysis is particularly relevant to the absolute calibration of a class of square-law electrical measuring instruments, but the formalism is also applicable to other network systems where impedance is a useful concept. ***W. E. Smith.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 228-233.

* **Properties and Applications of Semiconductor Diodes.** In electrical measurements copper oxide, Se, Ge, and Si rectifiers have become of greater importance. After a short explanation of their properties and mode of operation in B and C rectification, the circuits requisite for the purpose are discussed. Mention is also made of the use of the semiconductor rectifiers for high-voltage measurements and for remote control. Finally, attention is called to effects on the scale position of measuring instruments. (*In German.*) Eigenschaften und Anwendungen von Halbleiter-Dioden. ***Hans Ferdinand Grave.*** *ETZ: Elektrotechnische Zeitschrift*, v. 81, Ausgabe A, no. 22, Oct. 24, 1960, p. 761-767.

* **Transistors in Measuring Technique; Properties and Application.** (*In German.*) Transistoren in der Messtechnik, Eigenschaften und Anwendung. ***Hellmut Schneider.*** *ETZ: Elektrotechnische Zeitschrift*, v. 81, Ausgabe A, no. 22, Oct. 24, 1960, p. 767-773.

* **Two-Terminal *RC* Networks and Theoretically Related Topics.** A derivation is given of the properties of the principal minors of successive orders of the nodal determinant of a lumped linear *RC* network, with particular reference to the question of multiple zeros of the various minors. The remainder of the paper is devoted to the study of a certain continued-fraction expansion which is shown to be of particular use in connection with 2-terminal *RC* networks, stability and related problems; new canonical forms for a Hurwitz polynomial are derived with its aid. Determinantal expressions for the continued-fraction coefficients are used to obtain some new forms of the stability criteria. ***O. P. D. Cutteridge.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 275-282.

* **Perturbation Theory of Resonant Cavities.** A detailed derivation is given of the perturbation formula for the frequency shift on introducing a sample of ferrite or dielectric material into a resonant cavity. The purpose of this is to make clear what assumptions are involved in the derivation; it is necessary to appreciate what these assumptions are in order to design accurate experiments. ***R. A. Waldron.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 272-274.

* **The Design of Cylindrical Metal-Plate Microwave Lenses Fed by Non-Resonant Slotted Waveguide Arrays.** The use of a suitably modified refractive index enables cylindrical lenses with squinting linear feeds to be designed by the usual 2-dimensional methods applicable to lenses with non-squinting feeds. An example is given of the design of a typical lens fed by a non-resonant slotted waveguide having a 20° squint angle. ***J. W. Crompton.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 330-333.

* **The Surface-Wave Aerial.** The theory of the surface-wave aerial is developed in detail, a necessary preliminary step being a full theoretical analysis of the properties of the first-order cylindrical surface wave. It is shown that a dielectric-coated cylinder which is approximately a wavelength in circumference can act as a waveguide for higher-order surface waves, of which the first order is an example. The "characteristic equation" is determined for the general case from which the cut-off frequency, propagation coefficient and conditions under which propagation can take place are derived in turn. ***W. Hersch.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 202-212.

* **Power Flow and Negative Wave Impedance in the Dielectric-Rod Waveguide.** ***E. F. F. Gillespie.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 198-201.

a • **Electrical Properties of Cleaved Germanium Surfaces.** The effects of O on the electrical properties of a cleaved Ge surface have been studied by measuring the field effect, conductance, and photoconductance. Upon cleavage, the surface is more p-type than the bulk and remains unchanged in a vacuum of about 10^{-9} mm Hg or less. When initially exposed to O, the conductance tends toward a more p-type surface; then the surface changes towards n-type continuously at a constant O pressure. When the system is evacuated, the surface reversibly becomes more p-type, indicating that O tends to make the surface more n-type. In addition, the slow relaxation of the field effect in O almost disappears in vacuum. The surface eventually becomes n-type in O at 15 mm Hg for all of the samples measured, an effect which has not apparently been observed on surfaces cleaned by Ar bombardment. The results are interpreted in terms of acceptor states at the surface and donor states which depend on sorbed O and produce a slow relaxation of the field effect. ***D. R. Palmer, S. R. Morrison, and C. E. Dauenbaugh.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 27-32.

b • **Penetration of Microwaves Into the Rarer Medium in Total Reflection.** When the hypotenuse surfaces of two 45°-45°-90° prisms are separated by a narrow air gap, part of the electromagnetic radiation incident on the prisms will be transmitted through both prisms and part will be internally reflected in the first prism. Theory indicates that for prisms of index of refraction, $n = \sqrt{3}$, the transmission coefficient for the electric vector parallel to the plane of incidence (T_{11}) varies as a function of the ratio of gap distance to wavelength, d/λ, the same as for the case of the electric vector perpendicular to the plane of incidence (T_1). For $n < \sqrt{3}$, T_{11} falls off more slowly with d/λ than T_1. For $n > \sqrt{3}$, T_{11} falls off more rapidly with d/λ than T_1. Transmission and reflection coefficients were measured experimentally as a function of d/λ for 3-cm waves with prisms made of paraffin, S, and sodium chloride. ***J. J. Brady, R. O. Brick, and M. D. Pearson.*** *Optical Society of America, Journal*, v. 50, Nov. 1960, p. 1080-1084.

c • **Interaction Between High-Power Microwave Losses and Magnetic Flux Reversal.** The off-resonance microwave absorption (subsidiary absorption) which frequently occurs at high-microwave power and which may exist even in the absence of an external dc magnetic field was used to observe the interaction between the magnetic flux reversal and the microwave loss processes in polycrystalline ferrite. These experiments have shown that the spin waves associated with high-power, off-resonance microwave absorption have a negligible effect on the flux reversal process. However, the flux reversal process has a marked effect on the high-power microwave loss. ***E. M. Gyorgy and F. B. Hagedorn.*** *Journal of Applied Physics*, v. 31, Oct. 1960, p. 1775-1778.

d • **Surface Space-Charge Calculations for Semiconductors.** Approximation formulas for the surface excesses of carriers at large values of the reduced surface and bulk potentials are derived, and computed results are presented. ***D. R. Frankl.*** *Journal of Applied Physics*, v. 31, Oct. 1960, p. 1752-1754.

e • **Anomalous Barrier Capacitance in *p-n* Junctions of InSb.** Reverse bias transition capacitance measurements on alloy diodes of InSb at 78 K give values a factor of three times those calculated from normal diode theory. This result is in contrast to the reasonable agreement obtained for diodes of germanium and gallium arsenide in a comparable doping range. The experimental techniques are critically reviewed and an attempt made to assess the implications of the results. ***C. A. Lee and G. Kaminsky.*** *Journal of Applied Physics*, v. 31, Oct. 1960, p. 1717-1719.

f • **Application of Magnetic Resonance Techniques to the Study of Semiconductor Surfaces.** ***G. K. Walters.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 43-50 + 1 plate.

g • **Impurity Conduction of Cleaned Germanium Surfaces at Low Temperatures.** The conductivity and Hall effect of cleaned Ge surfaces have been measured in the temperature range between 1.7 K and 300 K. The surface was cleaned by Joule heating at ~800-850 C in ultra-high vacuum for ~20-30 hr and was then annealed at 650 C for several hours. Results obtained with ~20-40 Ω—cm p-type samples show that the Hall coefficient has a steep maximum at ~10-20 K and the resistivity

becomes flat below this temperature range. This character is similar to that of bulk impurity conduction found by Hung et al., but disappears on exposure to air which causes marked increases in both the Hall coefficient and resistivity at low temperatures. This impurity conduction is attributed to the surface imperfections introduced by the cleaning treatment of the surface. The mobility and concentration of carriers in this surface conduction are estimated. ***A. Kobayashi, Z. Oda, S. Kawaji, H. Arata, and K. Sugiyama.*** *Physics and Chemistry of Solids,* v. 14, July 1960, p. 37-42.

Surface Properties of Vacuum Cleaned Silicon. Measurement of conductivity, photoconductivity and change in contact potential with light have been made on a sample of floating zone single crystal Si cleaned by positive ion bombardment and annealed. The absence of a conducting *p*-film after such treatment has been demonstrated. The annealing after bombardment has been measured as a function of time at various temperatures. Changes in the bulk carrier concentration have been studied after various heating treatments. Changes in conductivity produced by Ar ions indicate that in the clean condition the Fermi level is about 0.1-0.2 eV above the valence band edge. Adsorption of atomic hydrogen decreases the conductivity of both heated and bombarded and annealed samples. At the same time ΔCP becomes more negative indicating a downward movement of the energy bands at the surface. ***J. T. Law.*** *Physics and Chemistry of Solids,* v. 14, July 1960, p. 9 + 15 pages.

Energy Level Diagrams for Germanium and Silicon Surfaces. The concept of localized atomic orbitals has been used to show how the structure and type of binding of surface atoms to the crystal may affect the energy level diagram of the surface region. In particular, it has been shown in a qualitative way that the *s* or *p* character of the nonbonding orbitals of the surface atoms may determine the energy of the surface state bands and the type of space charge region at cleaned Ge and Si surfaces. The transport data of the *p*-type space charge region of the cleaned Ge have been used to determine the parameters, N_0, the density of states per cm²eV, and $(E_r - E_0)$, the degree of degeneracy of a two-dimensional surface state band. Using the value of these parameters obtained from the transport data and the simple model of a two-dimensional surface state band, it has been shown that the linear temperature dependence of the thermionic emission data of Allen on Si may be predicted to within a factor of two or three. ***P. Handler.*** *Physics and Chemistry of Solids,* v. 14, July 1960, p. 1-8.

*** Surface Currents in Inversion Layers of Semiconductors.** The current mechanism taking place in inversion layers with application of an external potential is derived theoretically by reference to the example of point contact rectifiers. Experimental results concerning the properties of the characteristic curves of formed point contact rectifiers are communicated. The measured values can be interpreted satisfactorily by the surface currents which can be presented analytically. (*In German.*) Oberflächenströme in Inversionsschichten an Halbleitern. ***Eberhard Groschwitz, Ernst Hofmeister, and Rudolf Ebhardt.*** *Archiv der Elektrischen Übertragung,* v. 14, Sept. 1960, p. 380-396.

*** Voltage Breakdown of Antennas at High Altitude.** The physical mechanism involved, including the roles of attachment, free diffusion, ambipolar diffusion, and nonuniform field distribution in the breakdown process, is qualitatively described. These factors are illustrated by breakdown curves for various antenna configurations under both CW and pulse conditions. ***W. E. Scharfman and T. Morita.*** *I.R.E. Proceedings,* v. 48, Nov. 1960, p. 1881-1887.

*** Amplitude Scintillation of Radio Star at Ultra-High Frequency.** Observations of radio star scintillation at a frequency of 915 Mc over a 12-month period (October, 1957-September, 1958) are described. By daily observations of Cygnus A (IAU 19N4A) over a wide range of elevation angles, both the amplitude and rate of scintillation were studied. It was found that the amplitude scintillation is strongest near the horizon and decreases rapidly as the altitude increased. It was also found that the mean fluctuation rate in the winter is about three times faster than that in the summer. ***H. C. Ko.*** *I.R.E. Proceedings,* v. 48, Nov. 1960, p. 1871-1880.

*** Construction of a Thermionic Energy Converter.** Some of the general design considerations for a cesium vapor-type thermionic energy converter are discussed. These include the questions of geometry and materials as well as cathode support and cathode lead design. The effect of the internal magnetic fields has been analyzed; it was found that there exists an upper optimum limit for the power handling capability per unit cell. The actual construction of a high power thermionic energy converter is described. ***F. G. Block, et al.*** *I.R.E. Proceedings,* v. 48, Nov. 1960, p. 1846-1852.

*** A Two-Color Input, Two-Color Output Image Intensifier Panel.** The solid-state panel is so constructed that it can be independently excited by either a visible image or a near-infrared image on the input. The visible input image excites one of the colors in the output image while the infrared input image excites the other color of the output image. ***F. H. Nicoll and Alan Sussman.*** *I.R.E. Proceedings,* v. 48, Nov. 1960, p. 1842-1846.

*** Space Diversity Measurements on a Visual Range Radio Link System.** A report is given on level recordings conducted over 21 months on a 82 kilometer long radio relay system equipped with two antennas having a vertical distance of 250 λ. Like in many other cases, not only a stabilization of short-duration level variations has been found, but also long-duration variations extending over several hours are compensated very often. (*In German.*) Raumdiversity-Messungen an einer Richtfunkstrecke mit optischer Sicht. ***U. Kühn.*** *Nachrichtentechnik,* v. 10, no. 10, Oct. 1960, p. 430-434.

*** Emission Decay Below Narrow Grid Apertures.** The allowable grid drive for an experimental gun with an 0.015 in. aperture is calculated to be 22 v corresponding to only 75 microamperes in the beam, while another experimental gun version could deliver only 20 microamperes for a safe operation. This is in contrast to a conventional gun with a 0.030 in. grid aperture which permits the use of 58 v grid drive, corresponding to 1.65 milliamperes in the beam, before field damages start. (*In French.*) La baisse de l'émission face aux ouvertures de grilles étroites. ***Aurelius Sandor.*** *Vide,* v. 15e, no. 89, Sept.-Oct. 1960, p. 373-380.

On the Influence of Diffusion and Surface Recombination Upon the GR Noise Spectrum of Semiconductors. It is shown that the earlier eigenfunction treatments of Hyde and of van Vliet and van der Ziel do not allow for the fact that Fourier coefficients of different spatial modes are correlated. A proper treatment based on a transmission line analogy is presented and the result is examined for the cases arising when the recombination process is: volume-limited; surface-limited; and diffusion-limited. ***K. S. Champlin.*** *Physica,* v. 26, Sept. 1960, p. 751-760.

Transistorized Frequency Stabilization for Reflex Klystrons Used in Magnetic Resonance. Description of a fully transistorized frequency stabilizer for reflex klystrons is given. This is suitable for magnetic-resonance experiments and other microwave applications, where frequency stability is essential. ***P. Jung.*** *Journal of Scientific Instruments,* v. 37, Oct. 1960, p. 372-374.

New Electronic Concept: "Tunnel Sandwich". Experimental cryogenic device permits electron tunneling, gives ultra-fast response to control by magnetic flux. *Chemical and Engineering News,* v. 38, no. 49, Dec. 5, 1960, p. 52.

An Approach to the Synthesis of Linear Networks Through Use of Normal Coordinate Transformations Leading to More General Topological Configurations. Essentially the same procedure is applicable to passive bilateral networks and to nonpassive and/or nonbilateral ones. Although tedious computations are involved, the availability of modern computers makes this method feasible and thus opens up a more general and potentially useful approach to network synthesis. ***Ernst A. Guillemin.*** *IRE Transactions on Circuit Theory,* v. CT-7, Aug. 1960, p. 40-48. (TK1 In6.6c Vis.)

Spectral Measurements of Sliding Tones. A sliding tone is defined as a frequency which changes linearly with time. Results are first developed for the spectral density of a finite fixed duration sinusoid of linearly time-varying frequency, from an in-

terpretation of the Cornu spiral. This is referred to as the input spectrum. The response of a filter to a sliding tone is then determined by convolution of the input spectrum with the selectivity characteristics of the filter. ***Will Gersch and James M. Kennedy.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 26-39. (TK1 In6.6c Vis.)

A Fourier Series Time Domain Approximation. A new method of approximation to the time domain function corresponding to a given completely stable system function is presented. An approximate Fourier series is found for the time domain function such that the coefficients are essentially a sequence of values of the system function. Explicit error estimates are given. ***D. R. Anderson.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 18-25. (TK1 In6.6c Vis.)

Transfer Function Synthesis of Active RC Networks. A simple active RC network synthesis technique is presented. The method is general in the sense that any stable voltage transfer functions with the exception of zeros on the positive real axis can be synthesized. Only a practical amplifier is needed for the active device. ***E. S. Kuh.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 3-7. (TK1 In6.6c Vis.)

Statistical Analysis of Transistor-Resistor Logic Networks. A mathematical model of the delay has been constructed which is a complicated function of circuit variables, as well as of the intrinsic parameters of the transistors involved. By using measured statistical data of transistor parameters and randomly sampled circuit variables as input, a Monte Carlo analysis of the distribution of propagation delay is carried out. ***Wallace J. Dunnet and Yu-Chi Ho.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 100-129. (TK1 In6.6c Vis.)

Synthesizing Minimal Stroke and Dagger Functions. The techniques of the functions tables, theorems of Boolian algebra, and Karnaugh maps, are extended to provide synthesizing and minimizing methods for the stroke and dagger functions. Describes the transformations among these and more familiar functions. ***John Earle.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 144-154. (TK1 In6.6c Vis.)

Smoothing and Prediction of Time Series by Cascaded Simple Averages. Optimum smoothing and prediction of sampled data frequently requires very large numbers of storage slots and large numbers of multiplications and additions per computing cycle. Several schemes are available for reducing these numbers substantially. One of these schemes is described. ***R. B. Blackman.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 136-143. (TK1 In6.6c Vis.)

An Analog Computer Nyquist Plotter. A scheme for obtaining Nyquist information from a time domain, analog simulation is presented. The scheme is based upon a sampling technique which can be implemented by standard analog computer circuity plus some special-purpose electronic circuits. ***E. A. Goldberg.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 130-135. (TK1 In6.6c Vis.)

Switching and Memory Criteria in Transistor Flip-Flops. A simple criterion is proposed to determine which storage elements can provide memory. Experimental results concerning minimum memory and maximum repetition frequency are presented. ***D. K. Lynn and D. O. Pederson.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 92-99. (TK1 In6.6c Vis.)

Application of Synthesis Techniques to Electronic Circuit Design. It is pointed out that at frequencies below about 30 KC, RC-active networks are competitive with other methods of filter design. Two of the synthesis techniques are used to realize a twelfth-order Tchebycheff parameter bandpass filter centered at 18 KC. ***F. H. Blecher.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 79-91. (TK1 In6.6c Vis.)

Some Properties of Time Varying Networks. The general theory of reactance amplifiers is exemplified. The particular case of three frequencies, e.g., p, q, p-q, is calculated for large signals. The phenomena of regeneration and oscillation, with subharmonic oscillation as a special case, are studied and illuminated. ***J. M. Manley.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 69-78. (TK1 In6.6c Vis.)

Physical Realizability Criteria. Under certain assumptions, an algebraic treatment appears to yield some nontrivial results. This method will be applied to the synthesis of n-ports containing both positive and negative resistors. Several theorems concerning n-port stability are also given. ***D. C. Youla.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 50-68. (TK1 In6.6c Vis.)

Using Digital Techniques in L-F Spectrum Analysis. Analyzer determines frequency spectrum of nonperiodic, as well as periodic, inputs. Digital circuits use speed-up process in modifying input wave for analysis. ***Bernard Grand, Leroy Packer, and James L. West.*** *Electronics*, v. 33, no. 46, Nov. 11, 1960, p. 78-81.

*** New Derivation of Bardeen-Shockley Formula for Mobility of Electrons in Homopolar Semi-Conductors.** The Bardeen-Shockley formula for the mobility of an electron or hole in a homopolar semiconductor is derived in a different way to that in which its authors obtained it. The interaction energy of the electron with the acoustic lattice oscillations is derived in an original way. A new possibility for determining the energy gap is given. ***L'. Hrivnák.*** *Czechoslovak Journal of Physics*, v. 10, no. 9, 1960, p. 633-644.

Tracking Missiles at Night by Light Flashes. Precisely timed, high-intensity light flashes from beacon in missile permit trajectories to be determined from distances to 400 miles. ***Alexander Finlay, Robert E. DeMuth, and William D. Hall.*** *Electronics*, v. 33, no. 46, Nov. 11, 1960, p. 88-89.

Broad-Band UHF Distributed Amplifiers Using Band-Pass Filter Techniques. Basic principles of distributed amplification as applied to the UHF band-pass amplifier are described in this paper. The modifying factors of major importance are evaluated and techniques for optimizing amplifier performance capabilities in the UHF region are discussed. Measured performance characteristics of several amplifiers are presented. ***Fred C. Thompson.*** *IRE Transactions on Circuit Theory* (Suppl.), v. CT-7, Aug. 1960, p. 8-17. (TK1 In6.6c Vis.)

Semiconducting Compounds. It is interesting, as well as surprising, to see how the many and various semiconducting compounds are all governed by the same simple chemical and structural rules. ***E. Mooser.*** *Science*, v. 132, Nov. 4, 1960, p. 1285-1291.

Determination and Identification of Impurities in Silicon From Low-Temperature Hall Data. Low-temperature measurements of the Hall effect have been used to determine donor and acceptor concentrations and in some cases to identify the major impurity in Si. A simple apparatus for making these measurements with liquid He is described. Typical results are presented and correlated with lifetime data at room temperature. Interpretation of the Hall coefficient measurements is discussed, and a simplified analysis of the case of the two types of donor impurity is suggested. ***R. T. Bate, L. R. Weingarten, and D. J. Shombert.*** *Electrochemical Society, Journal*, v. 107, Nov. 1960, p. 908-911.

*** Adaptive Control Systems. A Survey.** Adaptive control is a natural extension of the more familiar feedback control which has reached an advanced state of development in the past 20 years. The next few years will undoubtedly see a corresponding advance in the design and use of adaptive control systems. The ultimate result will be the development of mechanisms which approximate still more closely the abilities of human beings, and the use of these mechanisms to extend man's control of nature. ***R. A. Mathias and R. I. Van Nice.*** *Electro-Technology*, v. 66, no. 4, Oct. 1960, p. 116-125.

Laminar Junction Layers. New Concept in Microcircuits. Silicon semiconductor devices can be formed by vapor deposition of single-crystal Si layers on single-crystal Si substrate. Technique is applicable to formation of complete circuits. ***J. E. Allegretti and D. J. Shombert.*** *Electronics*, v. 33, no. 49, Dec. 2, 1960, p. 55-57.

Organics Invade Strange New Territory. A survey of research in the field of organic semiconductors. *Chemical Week*, v. 87, no. 19, Nov. 5, 1960, p. 103 + 2 pages.

Crystal Stability and the Theory of Ferroelectricity. The phenomenon of ferroelectricity in pseudo-cubic crystals is discussed in terms of the normal modes of vibration. It is shown that the parameters which determine the lattice vibrations of a diatomic ionic crystal may be chosen in such a way that the crystal will exhibit ferroelectric properties, and that ferrolectric or anti-ferroelectric transitions may be regarded as the result of an instability of the crystal for a certain normal mode of vibration. ***W. Cochran.*** *Advances in Physics*, v. 9, no. 36, Oct. 1960, p. 387-423.

* **The Use of Diffused Junctions in Silicon as Fast-Neutron Dosimeters.** In summary, it can be stated that a Si-diffused conductivity-modulated device has demonstrated its possible use as a fast-neutron dosimeter in the tissue damage range. ***O. J. Mengali, E. Paskell, R. W. Beck, and C. S. Peet.*** Paper from "Proceedings of the Second Conference on Nuclear Radiation Effects on Semiconductor Devices, Materials and Circuits", p. 108-110, 1960. Cowan Publishing Corp., New York. (QC612.S4 C77p Over.)

* **Radiation Effects in Compound Semiconductors.** The number of carriers removed per incident neutron are compared for the following materials: SiC, Si, GaAs, InP, Ge, AlSb, GaSb, and CdTe. Analysis of post-irradiation measurements indicated bombardment-produced levels in AlSb at 0.33 *ev* above the valence band, in InP at 0.28 *ev* below the conduction band, and in GaAs at about 0.14 *ev* below the conduction band. Below room temperature ($\tilde{=}$ 250 K) at "mobility catastrophy" was observed in an irradiated GaAs specimen. High temperature annealing studies carried on GaAs indicate an annealing process at about 300 C, and further annealing above 400 C. ***L. W. Aukerman.*** Paper from "Proceedings of the Second Conference on Nuclear Radiation Effects on Semiconductor Devices, Materials and Circuits", p. 26-30, 1960. Cowan Publishing Corp., New York. (QC612.S4 C77p Over.)

The Diffusion of Ionized Impurities in Semiconductors. The diffusion coefficient of an impurity in a semiconductor depends on the state of ionization of the impurity, i.e., on whether the Fermi level lies above or below the impurity energy level. A simple model, namely, the one-dimensional diffusion of a shallow acceptor, is used to illustrate this and the results are applied to the diffusion of Zn in gallium arsenide. ***J. W. Allen.*** *Physics and Chemistry of Solids*, v. 15, nos. 1-2, Aug. 1960, p. 134-139 + 1 plate.

* **Stabilized Voltages Supplies Using Transistors.** Two methods of obtaining ± 300V stabilized supplies from a common low voltage source are described. The first circuit described is of a novel type. The second type follows the more usual form of series stabilizer, modified to use transistors throughout. ***J. S. Bell and P. G. Wright.*** *Electronic Engineering*, v. 32, Dec. 1960, p. 758-761.

* **A Reversible Dekatron Circuit.** Describes a reversible counter built with the slower type of Dekatron tubes. The speed is therefore limited to about 4kc/s, but the same principles could be applied in a counter using the faster tubes. ***A. J. Oxley.*** *Electronic Engineering*, v. 32, Dec. 1960, p. 746-749.

* **Generalized Padé Approximation.** Approximation by minimizing the magnitude of the complex error phasor in the steady state is considered and relationships to conventional magnitude-only and phase-only methods are discussed. The particular case of the Taylor approximation about zero frequency is shown to be equivalent to the Taylor approximation in terms of the complex variable. ***J. L. Stewart.*** *I.R.E. Proceedings*, v. 48, Dec. 1960, p. 2003-2008.

* **An Improved Decision Technique for Frequency-Shift Communications Systems.** Describes a new circuit technique called a decision threshold computer, which enables a frequency-shift-keyed receiver system to use information in mark and space channels independently, resulting in an improvement in circuit quality where fading exists between the mark and space frequencies. Frequency selective fading observed on ionospheric-scatter circuits and on high-frequency communication circuits is discussed. The results of a correlation study are presented which show such fading to be relatively uncorrelated a large portion of the time. ***Elmer Thomas.*** *I.R.E. Proceedings*, v. 48, Dec. 1960, p. 1998-2003.

* **Regenerative Fractional Frequency Generators.** A new regenerative frequency divider circuit is presented which offers several advantages over other available circuits. These advantages are large lock-in or "stability" range, ability to produce either relatively constant output or amplitude modulated output, circuit simplicity and the fact that it is self-starting. ***S. Plotkin and O. Lumpkin.*** *I.R.E. Proceedings*, v. 48, Dec. 1960, p. 1988-1997.

* **Coupled-Cavity Traveling-Wave Parametric Amplifiers: I. Analysis. II. Experiments.** A general class of traveling-wave parametric amplifiers based on coupled-cavity filter circuits is described. This type of amplifier is particularly suited to microwave frequencies and incorporates new features that overcome some severe difficulties associated with other circuit structures. An analysis is presented which provides detailed information on operating characteristics, including the effects of terminal impedances, reflected waves, circuit loss, etc. The filter-circuit approach to broadband traveling-wave parametric amplification at microwave frequencies is described from an experimental point of view. The experiment revolves around a series of inductively coupled microwave cavities, each loaded with one variable-capacitance semiconductor diode. The effects of the many variables on the performance of the amplifier are described. I. ***M. R. Currie and R. W. Gould.*** II. ***K. P. Grabowski and R. D. Weglein.*** *I.R.E. Proceedings*, v. 48, Dec. 1960, p. 1960-1987.

* **Electron-Optical Properties of a Flat Television Picture Tube.** Ray paths and focusing properties are calculated for the deflection and acceleration fields of a flat picture tube with lateral beam injection. It is found that linear deflection can be obtained by the application of voltage variations to the deflection electrodes which do not depart greatly from linear variations between the prescribed maximum and minimum values. ***E. G. Ramberg.*** *I.R.E. Proceedings*, v. 48, Dec. 1960, p. 1952-1960.

ENGINEERING ECONOMICS

The Trouble With Profit Maximization. Here is a case in which the real world is more worthy than its textbook picture, as well as more practical. Business decisions are not made, and cannot be made, with the sole purpose of maximizing profits. ***Robert N. Anthony.*** *Harvard Business Review*, v. 38, no. 6, Nov.-Dec. 1960, p. 126-134.

Tax Favoritism to Cooperatives. Private enterprises may be out of business, argues this author, by the unfair competition of cooperatives and publicly owned utilities—whose strength comes more from tax advantages than from operating efficiencies. ***Harry G. Guthmann.*** *Harvard Business Review*, v. 38, no. 6, Nov.-Dec. 1960, p. 116-125.

Survey of the Canadian Iron Ore Industry During 1959. Canadian producers' shipments of iron ore reached an all-time high of 21,854,468 tons in 1959. This was 9.5% above the 1956 record of 19,953,820 tons and 55% above the total for the recessional year 1958. Owing to the steel strike in the U. S., which lasted from July 15 to Nov. 7 and closed that country's iron ore mines, the traditional imports into Ontario from the Lake Superior area of the U. S. were lower than normal. The annual volume of Canadian iron-ore shipments is influenced greatly by the production of iron and steel in the U. S., western Europe, Japan and Canada. It is expected that Fe and steel production in all four market areas will be high in varying degrees throughout most of 1960. ***R. B. Elver.*** *Canada, Mines Branch, Mineral Information Bulletin MR* 45, 1960, 121 pp. (TN26 C16.55m Contin.)

Economic Considerations in Postponing Investment. A method of determining how long to put off a deferrable investment. ***Harry A. Quigley and James B. Weaver.*** *Industrial and Engineering Chemistry*, v. 52, Nov. 1960, p. 57A-58A.

* **Recent Changes in Europe's Trade.** A comprehensive résumé, including the development of the European Economic Community and the European Free Trade Association during

1959-1960. *United Nations, Economic Bulletin for Europe*, v. 12, no. 2, Sept. 1960, p. 1-49.

* **Latin American Economic Development: Some Basic Issues.** Performance in the recent past; internal policies and administration; domestic and foreign investment; export markets and foreign exchange; problems for U. S. policy in Latin America. ***Raymond F. Mikesell.*** *Journal of International Affairs*, v. 14, no. 2, 1960, p. 126-139.

* **United States Investment in Latin America: Problems and Prospects.** ***David Felix.*** *Journal of International Affairs*, v. 14, no. 2, 1960, p. 140-151.

* **United States-Canadian Economic Relations: The Search for a Home-Owned Soul.** Outlines sources of friction between Canada and U. S. ***Richard E. Caves.*** *Journal of International Affairs*, v. 14, no. 2, 1960, p. 175-186.

* **Relationships Between Organization Size and Efficiency.** The relation between productivity, efficiency, and size of a technical organization as affected by internally generated and circulated paperwork is analyzed. ***F. P. Adler.*** *Management Science*, v. 7, no. 1, Oct. 1960, p. 80-84.

* **The Coal Problem in Great Britain and the World.** Reviews the present and future uses and reserves of coal. ***John T. Whetton.*** *Canadian Mining and Metallurgical Bulletin*, v. 53, no. 582, Oct. 1960, p. 742-746; *Canadian Institute of Mining and Metallurgy, Transactions*, v. 63, 1960, p. 492-496.

* **Market Growth, Company Diversification and Product Concentration.** The hypothesis that market growth leads to lower levels of product concentration received positive support from two tests. First, it was found that the level of concentration declined in those product classes that, in the aggregate, showed a higher than average rate of growth. More convincing, when concentration change was correlated with growth rate for individual product classes, a negative and statistically signficant relationship was found. ***Ralph L. Nelson.*** *American Statistical Association, Journal*, v. 55, no. 292, Dec. 1960, p. 640-649.

* **Estimating Plant Investment Costs.** Compute your total plant investment by this improved method, using size and cost of basic equipment in the process design. ***Joel H. Hirsch and Edwin M. Glazier.*** *Chemical Engineering Progress*, v. 56, Dec. 1960, p. 37-43.

* **The Competitive Potential of Synthetic Rubber.** Natural rubber can compete successfully with synthetics only if production efficiency can be increased in the next few years. ***Charles F. Phillips, Jr.*** *Land Economics*, v. 36, no. 4, Nov. 1960, p. 322-332.

* **Economics Are Basic for Plant Location.** In selection of chemical plant sites, raw material and market locations are traditionally the primary considerations. ***Erwin von Allmen.*** *Chemical Engineering Progress*, v. 56, Nov. 1960, p. 37-41.

* **Evaluating Project Economics.** Cost of capital, evaluating project returns, payback, simple return on investment, time-adjusted rate of return, profitability index, and risk considerations are discussed. ***Thomas C. Stout and John W. Weber.*** *Automation*, v. 7, Dec. 1960, p. 46-54.

FLUID MECHANICS

Study of Molar Sound Velocity in Liquids. A study of a number of six- and five-membered compounds revealed positive contribution to molar sound velocity due to these ring structures. From a study of about ten liquids containing semipolar bonds, it is shown that this type of linkage contributes a negative value to the molar sound velocity. Molar sound velocity increments for several atoms and bonds for which the data are not available are reported. ***P. R. K. L. Padmini, K. Subba Rao, and B. Ramachandra Rao.*** *Faraday Society, Transactions*, v. 56, Oct. 1960, p. 1404-1408.

a * **Hydromagnetic Oscillations of a Rotating Liquid Sphere.** The equation governing hydromagnetic oscillations of a liquid globe rotating in a uniform magnetic field is solved in cylindrical polar coordinates and the solution is adapted to satisfy spherical boundary conditions. The period equation is obtained in the form of an infinite determinant. ***P. C. Kendall.*** *Quarterly Journal of Mechanics and Applied Mathematics*, v. 13, pt. 3, Aug. 1960, p. 285-299.

b * **Transport Properties of Liquids in Relation to Their Structure.** Considers the state of the theory of transport properties for simple liquid systems and how molecular structure influences these properties for more complex systems. ***E. McLaughlin.*** *Chemical Society, Quarterly Reviews*, v. 14, no. 3, 1960, p. 236-256.

c **Growth of Vapor Bubbles in a Rapidly Heated Liquid.** Earlier theory of the growth in superheated liquids is extended to the situation in which the rate of temperature rise of the liquid is large. ***S. A. Zwick.*** *Physics of Fluids*, v. 3, no. 5, Sept.-Oct. 1960, p. 685-692.

d * **The Characteristic System for Three-Dimensional, Steady, Isentropic, Compressible, Hydromagnetic Flows.** ***N. Coburn and R. S. B. Ong.*** *Journal of Mathematics and Mechanics*, v. 9, no. 5, Sept. 1960, p. 715-732.

e **An Automatic Concentric-Cylinder Rotational Viscometer for Rheological Measurements of Non-Newtonian Materials.** Records flow curves of shear stress versus rate of shear. It provides an automatic means of increasing and decreasing the applied rates of shear and an automatic control of the time that each shear rate is applied to the sample. ***A. F. Gabrysh, et al.*** *Utah Engineering Experiment Station, Bulletin No.* 106, Sept. 1960, 52 pp. (QE169 Ut1.82b Vis.)

f * **The Decay of Magnetohydrodynamic Turbulence.** The role of the correlation between kinetic and magnetic fields is discussed. ***P. H. Roberts and T. Tatsumi.*** *Journal of Mathematics and Mechanics*, v. 9, no. 5, Sept. 1960, p. 697-713.

g **Comparison of the Activation Energy for the Reorientation of Molecules With the Activation Energy of Viscous Flow.** Above were calculated by the broadening of Raman spectrum lines; these energies were compared with the activation energies for viscous flow. ***M. F. Vuks.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 47-48.

h * **Photographic Observations on Shock Waves in Liquids.** A simple method of photographing shock waves in liquids and of observing the absorption spectra of solutions under the extreme pressure and temperature conditions of shock waves is described. A thin layer of Ar, compressed and heated by a shock wave, is used as a high-intensity, short-duration (0.2 μsec) flash source. The absorption spectra of the uranyl and neodymium ions are shown to be altered under these conditions. ***H. G. David and A. H. Ewald.*** *Australian Journal of Applied Science*, v. 2, no. 3, Sept. 1960, p. 317-320 + 2 plates.

i * **Viscoplastic Flow Between Rotating Discs.** Equations are cited and discussed for two cases: when the compact discs of a given radius approach each other at a low speed; and, when into the space between the discs continuously proceeds a viscous-plastic median. (*In Russian.*) Techenie viazko-plastichnoi sredy mezhdu vrashchaiushchimisia diskami. ***A. M. Gutkin.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1048-1050.

j * **A Unified Theory of Turbulent Flow. II. Plane Couette Flow.** A general theory of turbulent flow is applied to incompressible plane Couette flow. It is found that a unique formulation is not obtained because of a singularity in the equations and problems relating to the boundary conditions. Solutions are obtained for several different assumptions. The characteristic feature is a square root velocity profile for high Reynolds numbers. ***William Squire.*** *Applied Scientific Research, Sec. A, Mechanics, Heat Chemical Engineering, Mathematical Methods*, v. 9, no. 6, 1960, p. 393-410.

FOOD TECHNOLOGY

The Mechanical Development of Bread Doughs. It was found that about 40 joules/gm. of work was required to produce optimum mechanical development of bread doughs. Experiments indicates that at least a substantial proportion of the mechanical work required for dough development is expended in breaking disulphide cross-links in the wheat protein, although other factors no doubt play a part. ***D. W. E. Axford and G. A. H. Elton.*** *Chemistry & Industry*, 1960, no. 41, Oct. 8, p. 1257-1258.

* **Observations on Protein Digestion in Vivo. III. Recovery of Nitrogen From the Stomach and Small Intestine at Intervals After Feeding Diets Containing Different Proteins.** ***Q. R. Rogers, M-L. Chen, C. Peraino, and A. E. Harper.*** *Journal of Nutrition*, v. 72, no. 3, Nov. 1960, p. 331-339.

* **Low Temperature Handling of Sterilized Foods. V. Biochemical Changes in Storage.** Advantage has been taken of the logarithmic order of thermal death of bacteria as opposed to first order kinetics of biochemical alterations during thermal processing to develop a number of commercial high temperature-short time thermal processes for canned product sterilization. Such processes can produce food products which are of relatively high initial quality. ***Aaron L. Brody, Karakian Bedrosian, and C. Olin Ball.*** *Food Technology*, v. 14, Nov. 1960, p. 552-556.

* **Volatiles Contributing to the Flavor of Bartlett Pears.** By processing fresh, ripe pears in a specially designed enclosed system, aqueous essences with the typical desirable aroma of Bartlett pears have been recovered. There are indications that Cu or copper alloys can cause flavor degradation. ***W. G. Jennings, S. Leonard, and Rose Marie Pangborn.*** *Food Technology*, v. 14, Nov. 1960, p. 587-590.

* **Roasted Coffee. Color Measurement and Classification.** Describes a simple, rapid, and precise method for measuring the color of roasted coffee, develops a graded list of names applicable to colors of roasted coffee, and shows the association between the two. ***Ernest E. Lockhart.*** *Food Technology*, v. 14, Nov. 1960, p. 597-600.

* **Investigation of Equivalent Weights of Dehydrated Vegetables in Comparison to Their Fresh Conventional Counterparts. I. Dehydrated Sliced Onions.** ***H. R. Ignall.*** *Food Technology*, v. 14, Nov. 1960, p. 601-603.

* **Availability of Amino Acids in Maize.** The availability of lysine, isoleucine, threonine, and methionine was determined in three samples of maize grown under different fertilizer conditions. No significant differences in availability were found among the three samples for the respective amino acids. ***Hector de Muelenaere and Ruth Feldman.*** *Journal of Nutrition*, v. 72, no. 4, Dec. 1960, p. 447-450.

* **Amino Acid Reference Patterns: A Comparison of the Pattern of Human Milk With the FAO Pattern in Human Nutrition.** Seven premature infants were fed a synthetic diet in which the protein moiety was a mixture of 18 L-amino acids. The amino acids were provided in two ratios—that of human milk and that of the FAO pattern. There were no differences in the weight curves or the amount of N retained, using the two types of diets. ***Selma E. Snyderman, L. Emmett Holt, Jr., and Audrey Boyer.*** *Journal of Nutrition*, v. 72, no. 4, Dec. 1960, p. 404-408.

* **Availability to Man of Amino Acids From Foods. III. Threonine From Corn. IV. Isoleucine From Corn.** ***Hellen Linkswiler, Hazel Metz Fox, and Peggy Crooke Fry.*** *Journal of Nutrition*, v. 72, no. 4, Dec. 1960, p. 389-403.

FUELS AND COMBUSTION

* **What Oil-Burning System for the Automatic Packaged Boiler? II.** *Power Engineering*, v. 64, Oct. 1960, p. 88-89.

a • * **Some Observations on the Radiative Combination of Atomic Hydrogen With Atomic Halogens in Burner Flames.** ***L. F. Phillips and T. M. Sugden.*** *Canadian Journal of Chemistry*, v. 38, Oct. 1960, p. 1804-1818 + 1 plate.

• **Property Requirements for Liquid Rocket Propellants.** Analyzes the properties necessary for propellants to give effective performance with acceptable handling. Comparisons are made. ***E. M. Goodger.*** *Institute of Petroleum Journal*, v. 46, Oct. 1960, p. 314-327.

b • * **Handling Liquid Hydrogen. A Hazardous Problem.** ***Arthur A. Fowle, Leon H. Cassutt, and C. Lincoln Jewett.*** *Missile Design & Development*, Oct. 1960, p. 36-39.

• * **High Octane—A Worldwide Specification.** An historical and geographical review of this product's distribution. *Heat Engineering*, v. 35, no. 5, Sept.-Oct. 1960, p. 162-167.

c • **Gas Burner Design Data.** Answers combustion problems involved in "compact" heating plants required for modern basementless homes. ***Wayne Schutmaat.*** *Metal Products Manufacturing*, v. 17, Nov. 1960, p. 30-32.

• **Film Vaporization Combustion Is Applicable to Gas Turbine Burner.** Is expected to minimize deposits and smoke. ***A. W. Hussmann and G. W. Maybach.*** *SAE Journal*, v. 68, Nov. 1960, p. 44-49.

d • **The Reaction Between Oxygen Atoms and Diborane.** The gas-phase reaction is produced by the Hg photosensitized decomposition of nitrous oxide. ***Francis P. Fehlner and Robert L. Strong.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1522-1526.

e • * **Phased Injection in Diesel Engines.** Considers that the phased injection of the total fuel charge will bring about better mixing of fuel and air and in consequence lower specific fuel consumption, combustion noise, smoke density, and other benefits. ***Y. M. Balakrishna and K. Mahadevan.*** *Indian Institute of Science, Journal*, v. 42, no. 3, July 1960, p. 66-84 + 7 plates.

f • * **The Impact on Coal Preparation of Smokeless Fuel Production and Total Gasification of Coal.** Predicts an increasing demand for coal by conversion into more convenient forms of fuel, and considers the effect of this development on coal preparation. ***W. R. Chapman.*** *Coke and Gas*, v. 22, Oct. 1960, p. 449-455.

g • **Flames and Furnaces. Combustion of Liquid Fuels.** Combustion in general, separate streams of vapor fuel and air, the high-pressure fluid atomized burner, medium- and low-pressure air atomized systems, and the pressure jet system are discussed. ***M. W. Thring.*** *Iron & Steel*, v. 33, no. 12, Nov. 1960, p. 542-546.

h • **Determination of Flame Velocities in Gaseous Predetonation.** The application of ionization gap or "pin" probes to measure flame velocities during the development of detonation is presented. Probe construction and circuit techniques are described which, despite the widely varying character of the ionization signals in this region, yield timing precision of 2% or less for H-O mixtures. Analysis of the ionization probe circuit permits the identification of the probe signal with the ionization levels encountered in the various waves generated during the development of detonation. ***G. J. Hecht, A. J. Laderman, R. A. Stern, and A. K. Oppenheim.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1107-1111.

i • **Solid Propellants.** Of prime interest aside from the materials themselves is the equipment that frequently must be designed to do a specific job in compounding, curing, or trimming operations. Due to the extreme sensitivity of the materials during processing, extensive safety precautions must be taken to protect personnel and equipment. Barricading and isolation of processing areas chiefly are discussed here. ***Bruce F. Greek, Charles F. Dougherty, and Walter J. Mundy.*** *Industrial and Engineering Chemistry*, v. 52, Dec. 1960, p. 974-980.

j • **The Reaction of Ozone With Methane.** The reaction was studied in temperature-controlled, infrared gas cells. Analysis showed the major reaction products to be CO, CO_2, formic acid, and water vapor. ***Frederick J. Dillemuth, Duane R. Skid-***

k

more, and Clarence C. Schubert. *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1496-1499.

* **The New Diagram of Burning Process Regulation for Drum Boilers With Shaft Mills.** The choice of new diagram of burning process regulation is substantiated. Describes the diagram and analyzes results of its test on the boiler. (*In Russian.*) Novaia skhema regulirovaniia protsessa goreniia dlia barabannykh kotlov s shakhtnymi mel'nitsami. ***N. I. Davidov, S. N. Afanasov, E. K. Rinkous, and B. A. Kouznetzov.*** *Teploenergetika*, v. 7, no. 10, Oct. 1960, p. 57-63.

Acoustical Systems Determine Oil Burner Pulsations and Their Amplitudes. Pulsations present in oil-fired heating units result from acoustical phenomena, even though the energy for driving the pulsations is derived from the combustion process. It is the acoustical system which determines the frequency, and to a large extent, the amplitude of the pulsations. Changes in furnace and burner variables which affect the combustion process also affect the acoustical system. The variables important to the generation of pulsations have been delineated; these are the furnace volume, the fuel-spray pattern, the air pattern, and the pattern of the recirculated hot-combustion products. The detailed mechanism of pulsation has been shown to involve two independent phenomena: an acoustic pressure oscillation and a periodic rate of heat release. ***C. F. Speich and A. A. Putnam.*** *ASHRAE Journal*, v. 2, Nov. 1960, p. 63-69.

Methane-Oxygen Flame Structure. I. Characteristic Profiles in a Low-Pressure, Laminar, Lean, Premixed Methane-Oxygen Flame. II. Conservation of Matter and Energy in the One-Tenth Atmosphere Flame. The experimental data on temperature, composition, and aerodynamic profiles through a flat, premixed CH_4-O_2 flame obtained by techniques described earlier are analyzed in terms of matter and energy conservation. The composition profiles for the seven stable species found in the flame are corrected for molecular diffusion. Approximations used in the treatment are critically discussed, and it is shown that general reliability of the results has been improved considerably over previous laminar flame structure analyses. ***A. A. Westenberg, R. M. Fristrom, C. Grunfelder, and S. Favin.*** *Journal of Physical Chemistry*, v. 64, Oct. 1960, p. 1386-1398.

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

* **The Use of Ion-Exchange Enrichment in the Determination of Trace Elements in Sea Water.** Sea water was treated with sufficient redistilled HCl to make the solution 0.1 *N* and was allowed to flow very slowly through a small column of a strongly basic anion-exchange resin (Amberlite IR-400). ***R. R. Brooks.*** *Analyst*, v. 85, Oct. 1960, p. 745-748.

* **Collected Papers on Planetary and Space Sciences.** Twelve papers on the above subject covering meteorite study, planetary atmospheres, and radiation. ***Gordon J. F. MacDonald, editor.*** *Journal of Geophysical Research*, v. 65, no. 10, Oct. 1960, p. 3025-3115.

* **Note on Surface Wind Stress Over Water at Low and High Wind Speeds.** ***Basil W. Wilson.*** *Journal of Geophysical Research*, v. 65, no. 10, Oct. 1960, p. 3377-3382.

* **Diffusion of Particles in the Earth's Radiation Belts.** Observations of the particle density near the equatorial plane at different distances from the earth are compared with a theoretical study of the diffusion of charged particles injected into the geomagnetic field well beyond the outer radiation belt and subsequently scattered by fluctuating electric or magnetic fields. ***N. Herlofson.*** *Physical Review Letters*, v. 5, no. 9, Nov. 1, 1960, p. 414-416.

Successful Application of the Gravitational-Inertial Classifier. A new high-efficiency classifier utilizing aerodynamic principles not previously employed in classifiers. *Mining Engineering*, v. 12, Nov. 1960, p. 1175-1176.

Magnetic Roasting of Iron Ores in a Traveling Grate Roaster. Reports the results of tests conducted on low-grade iron ores in an effort to develop such a roaster for large-scale commercial operations. ***H. H. Wade and N. F. Schulz.*** *Mining Engineering*, v. 12, Nov. 1960, p. 1161-1165.

* **The Application of Sulphur Isotope Studies in Ore Genesis Theory—A Suggested Model.** Application of S^{33}/S^{34} measurements in ore genesis studies is examined. ***R. L. Stanton.*** *New Zealand Journal of Geology and Geophysics*, v. 3, no. 3, Aug. 1960, p. 375-389.

New Developments in Hail Research. Artificial production of hailstones and understanding their natural formation. ***Roland List.*** *Science*, v. 132, Oct. 21, 1960, p. 1091-1098.

* **Seismic Waves From High-Altitude Nuclear Explosions.** Seismic waves of long period were well recorded at epicentral distances as great as 9300 km from two high-altitude nuclear explosions, Teak and Orange, which were fired in the Johnston Island area on Aug. 1 and 12, 1958, respectively. ***Paul Pomeroy and Jack Oliver.*** *Journal of Geophysical Research*, v. 65, no. 10, Oct. 1960, p. 3445-3457.

* **Design and Operation of Jet-Bit Programs for Maximum Hydraulic Horsepower, Impact Force or Jet Velocity.** ***H. A. Kendall and W. C. Goins, Jr.*** *Journal of Petroleum Technology*, v. 12; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 219, Oct. 1960, p. 238-250.

* **Miscible Fluid Displacement—Prediction of Miscibility.** A method was devised for calculating the approximate conditions for a miscible displacement of reservoir fluid by rich, light hydrocarbon gases or by LPG mixtures. Miscibility is favored by increased pressures, decreased temperatures, light reservoir fluids and light hydrocarbon-displacing fluids rich in the heavier components. ***A. L. Benham, W. E. Dowden, and W. J. Kunzman.*** *Journal of Petroleum Technology*, v. 12; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 219, Oct. 1960, p. 229-237.

* **Geochemical Prospecting.** Analyzes general prospecting conditions, detection of primary anomalies and secondary indications, and describes some hydrogeochemical and biochemical methods as well as prerequisites for geochemical prospecting and its application. (*In German.*) Geochemische Prospektion. ***Friedrich Leutwein.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 13, Oct. 1960, p. 493-498.

* **A Practical Look at Slim-Hole Drilling.** The conditions for slim-hole drilling are: programmed well depth is not beyond range of available equipment; formations to be penetrated should not be extremely hard; no serious hole deviation tendencies expected; expected hole conditions do not require protective casing strings. ***B. A. Aggers.*** *Petroleum Engineer*, v. 32, Nov. 1960, p. B34 + 3 pages.

* **Iron Mining at Krivoy Rog U.S.S.R.** Krivoy Rog is one of the world's really great iron fields, not only as an important mineral resource, but also in its character as a field of well-operated mines. Historical and geological problems, mining operations, drilling, haulage, and ground support are discussed. ***H. R. Rice.*** *Canadian Mining Journal*, v. 81, Nov. 1960, p. 63-70.

* **Galactic Matter and Interstellar Flight.** A vehicle which uses the interstellar gas as a source of energy (by nuclear fusion), and as a working fluid is described. Study of the relativistic flight mechanics of this interstellar ramjet shows that maximum vehicle accelerations of the order of earth-gravity can be achieved with fusion-powered vehicles only if the frontal area loading density per unit interstellar gas density is 10^{-5} (gm/cm^2) per (reactive nucleon/cm^3) or less. ***R. W. Bussard.*** *Astronautica Acta*, v. 6, no. 4, 1960, p. 179-194.

* **The Measurement of Rock Pressures Induced by Mineral Extraction.** Measuring the stress condition in the interior of rocks surrounding underground openings is considered. ***A. N. May.*** *Canadian Mining and Metallurgical Bulletin*, v. 53, no. 582, Oct. 1960, p. 747-753; *Canadian Institute of Mining and Metallurgy, Transactions*, v. 63, 1960, p. 497-503.

The Possibility of Detecting a Gravitational Red Shift in 21-cm Radiation From the Galaxy. An observation of the red shift in our own or an external galaxy would be very valuable; but there seems to be little possibility of recognizing it, until the detailed structure and motions have been established. ***F. J. Kerr.*** *Nature*, v. 188, Oct. 15, 1960, p. 216-217.

Some Characteristics of Geomagnetic Micropulsations (Pc). Ordinary and extraordinary micropulsations are discussed. ***J. A. Jacobs and K. Sinno.*** *Nature*, v. 188, Oct. 22, 1960, p. 285-287.

Recent Re-Entry Research and the Cosmic Origin of Tektites. ***Dean R. Chapman.*** *Nature*, v. 188, Oct. 29, 1960, p. 353-355.

* **An Analysis of Meteorological and Aerological Data With the Aid of an Electronic Computer.** Analysis is discussed with formulas and examples on hand. (*In Russian.*) Analiz meteorologicheskikh i aerologicheskikh dannykh s pomoshch'iu elektronnoĭ vychislitel'noĭ mashiny. ***V. V. Bykov and G. P. Kurbatkin.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1065-1068.

The Chilean Earthquakes of May 1960. Studies of the disaster increase our understanding of earth shocks and of ways to withstand them. ***C. Martin Duke.*** *Science*, v. 132, Dec. 16, 1960, p. 1797-1802.

* **Isotopic Composition of Silver in an Iron Meteorite. V.** ***Rama Murthy.*** *Physical Review Letters*, v. 5, no. 12, Dec. 15, 1960, p. 539-541.

* **Some Aspects of the Distribution of Barium, Strontium, Iron, and Titanium in Plagioclase Feldspars.** ***Sisir K. Sen.*** *Journal of Geology*, v. 68, no. 6, Nov. 1960, p. 638-665.

* **On the Marine Geochemistry of Barium.** The depth distribution of Ba is similar to that of Ra. Barium in solution probably exists in two principal forms, divalent Ba ion and undissociated $BaSO_4$. ***Tsaihwa J. Chow and E. D. Goldberg.*** *Geochimica et Cosmochimica Acta*, v. 20, nos. 3-4, Nov. 1960, p. 192-198.

* **Some Aspects of the Thermal Evolution of the Earth.** Empirical data relating to the thermal history of the earth are examined. Recent astronomic and geochemical evidence strongly suggests that the earth formed by accretion from an initially low-temperature gas-dust cloud of solar composition. ***A. E. Ringwood.*** *Geochimica et Cosmochimica Acta*, v. 20, nos. 3-4, Nov. 1960, p. 241-259.

GRAPHIC ARTS

* **Technology of New Film Bases.** New types of synthetic film base require a new technology in manufacture. They are superior to the traditional cellulose bases in certain, but not all, respects. The new bases are a challenge to photographic engineers to exploit them. ***J. M. Calhoun.*** *Perspective*, v. 2, no. 3, 1960, p. 250-256.

* **Towards Universal Film Speeds.** Speed criteria of sensitive materials keep being revised. Practical users may be able to ignore the more theoretical aspects, but are concerned with finding an international and comprehensive system. ***L. A. Mannheim.*** *Perspective*, v. 2, no. 3, 1960, p. 243-249.

* **Measurement of the Dynamic Characteristics of Perforating Shaped Charges by the Use of Ultra High-Speed Photographic Techniques.** ***David E. Brink, Thomas C. Poulter, and Blake M. Caldwell.*** *Journal of Petroleum Technology*, v. 12, Oct. 1960, p. 77 + 1 page.

* **Siemens 2000 Projector for 16 mm Film.** ***Horst Maschgan.*** *Siemens Review*, v. 27, no. 7, Aug. 1960, p. 222-228.

* **Quality Factors in Powderless Etching.** The powderless etching machine applies a temperature-controlled emulsion, mechanically mixed, onto the oscillating or rotating surface of the plate being etched, with an even, measurable, and variable strength of impact, the variability of which can be controlled. ***Eric A. Williams.*** *British Printer*, v. 73, Nov. 1960, p. 103-105.

* **Camera Attachment for Photography of Oscilloscope Traces.** Pictures show the combination of units, which have been found reliable as a relatively inexpensive assembly for taking photographs of cathode-ray oscillograph figures, at the usual range of sweep speeds. ***Herbert Shapiro.*** *Biological Photographic Association*, v. 28, no. 3, Aug. 1960, p. 97-98.

* **A Method of Reproducing 35mm. Color Transparencies.** Apparatus is simple, reasonable in cost, and may be operated with ease. ***Joseph Thomas Lappan.*** *Biological Photographic Association*, v. 28, no. 3, Aug. 1960, p. 113-116.

HEAT POWER

Solar Regenerative Fuel Cell System on the Way. Regeneration and fuel cell phases work separately in lab tests. Next step is to combine them. ***E. Findl, W. R. Lee, J. D. Margerum, and W. E. McKee.*** *SAE Journal*, v. 68, Nov. 1960, p. 84-87.

Modifications Raise Polaris' Range. Second-stage of the A-2 case wil be made of Spiralloy and chances are good that the wound glass filament will be used for both stages in future models. *Missiles and Rockets*, v. 7, no. 18, Oct. 31, 1960, p. 36-37.

* **Gasoline Injector for Spark-Ignition Engine Has Electric Control.** A simplified system for conventional gasoline engines. ***Robert Candlish.*** *Design News*, v. 15, Nov. 7, 1960, p. 22-23.

The High-Speed Heavy-Duty Diesel Engine: Its Development, Design and Application. ***Ekhart Schmidt.*** *Chartered Mechanical Engineer*, v. 7, no. 8, Oct. 1960, p. 393-410.

Pressure Waves in Internal Combustion Engines. A study of their action has led to development of the "comprex", or pressure exchanger, which can operate with any source of hot gas and serve as a supercharger or an industrial compressor. ***R. S. Benson.*** *New Scientist*, v. 8, Oct. 6, 1960, p. 930-932.

Oscillating-Electron Ion Engine Tested. An unusual oscillating-electron bombardment ion source that produces a high-velocity, electrically neutral plasma beam. ***Michael Yaffee.*** *Aviation Week and Space Technology*, v. 73, Oct. 31, 1960, p. 73 + 4 pages.

* **Fuel Cells: A Bigh Push Gets Bigger.** General discussion of cell; how it works, its uses, and its future. ***B. G. A. Skrotzki and J. J. O'Connor, editors.*** *Power*, v. 104, Nov. 1960, p. 59-63.

Electric Propulsion for Space Flight. The salient features of electric spacecraft mission analysis are listed, and some recent advances in fast interplanetary flight paths are discussed. Examples of electric power-plant and vehicle design studies are presented. Electrothermal, plasma, and ion rocket engines are described in detail. ***William R. Mickelsen.*** *Aero/Space Engineering*, v. 19, Nov. 1960, p. 6 + 14 pages.

Simulated Flight Testing of a Cowled Turbojet Engine by Use of an Exhaust Ejector. A simple, inexpensive method of testing jet engines and calibrating flight-test instrumentation at simulated flight conditions is presented. ***J. C. Armstrong, R. W. Flados, and W. T. McKenzie.*** *Aero/Space Engineering*, v. 19, Nov. 1960, p. 16 + 4 pages.

* **Power Plants for Supersonic Transports.** Concludes that development of military turbojet engines for speeds of a Mach number of 2-3 has provided the state-of-the-art knowledge, production know-how, and operational experience necessary to produce a supersonic transport engine. ***J. S. Alford.*** *Royal Aeronautical Society, Journal*, v. 64, Oct. 1960, p. 617-628.

* **Reciprocal Action Between Fuel and Motor.** Ascertainment of fuel consumption per distance, season, time of day, driver; simultaneous measurement of motor revolutions, gear changes and length of gear engagement time; subsequent formulation of

an electrically controlled test bench procedure simulating road conditions. (*In German.*) Uber die Wechselwirkung zwischen Kraftstoff und Motor. ***Martin Rossenbeck.*** *ATZ Automobiltechnische Zeitschrift*, v. 62, Oct. 1960, p. 266-273.

Energy Conversion Is Allison's Business. Allison is convinced that the best solar collector is a Fresnel reflector. Since the mirror lies practically in a single plane, it lends itself to compact folding. The division has perfected a method of manufacturing these reflectors through electrical deposition. ***John Judge.*** *Missiles and Rockets*, v. 7, no. 20, Nov. 14, 1960, p. 22-23.

* **Temperature Test of High Pressure Turbines Manufactured by the Leningrad Metallic Works.** Presents review and some results of work accomplished by steam turbine laboratory arranged for study of temperature fields arising in high pressure turbines during unstable state of operation. (*In Russian.*) Temperaturnye ispytaniia turbin vysokogo davleniia LMZ. ***P. G. Tretiakov and B. L. Levchenko.*** *Teploenergetika*, v. 7, no. 10, Oct. 1960, p. 22-27.

* **Liquid-Fuel Rocket Engines for the Propulsion of Missiles and Aeroplanes.** There are factors in favor of the assumption that the liquid-fuel rockets of the thrust range mentioned above need not be completely replaced by other developments. Their applications imply special requirements that must be met by the fuels and their feed systems. Of paramount importance, however, are the problems of the combustion chamber, among which one should mention the instability of combustion and thermal stress in connection with the properties of the materials. (*In German.*) Flüssigkeits-Raketentriebwerke kleinerer Schübe für den Antrieb von Flugkörpern und Flugzeugen. ***Lutz von Bonin.*** *Luftfahrttechnik*, v. 6, Oct. 1960, p. 298-306.

* **Studies of a Plasma Pinch Space Engine.** A pinch can not exist in a continuum if the current carrying sheet or skin is not established. To establish the current carrying sheet, it is necessary to meet certain frequency and conductivity requirements. This "pre-pinch" condition is currently under investigation. It is necessary to have a rate of current increase above a certain minimum if one is to achieve a pinch. ***Irving Granet, William Guman, and William McIlroy.*** *American Society of Naval Engineers, Journal*, v. 72, no. 4, Nov. 1960, p. 715-725.

Fuel Cell Uses Natural Gas, Steam, Oxygen. Experimental 2-watt battery may be forerunner of 10-kw home power pack no larger than a gas furnace. *Chemical and Engineering News*, v. 38, no. 49, Dec. 5, 1960, p. 56.

Throttled Liquid Hydrogen-Fluorine Engine. Smooth starting and combustion with engine chamber pressures below 60 psia promise a wide thrust range for a variable thrust liquid H-F rocket engine. ***Edward W. Otto and Richard A. Flage.*** *SAE Journal*, v. 68, Dec. 1960, p. 58-59.

Fuel Cell Thermodynamics. A simple fuel cell, operated reversibly, puts out, either electrochemically or in osmotic-mechanical form, an amount of useful work equal to the chemical potential released isothermally by the fuel plus O upon their combination. A coupled fuel cell regenerates the cell reagents by decomposing the reaction products at a high temperature. It thus acts as a heat engine in converting heat from a nuclear reactor into useful work. ***Andre J. deBethune.*** *Electrochemical Society, Journal*, v. 107, Nov. 1960, p. 937-939.

How a Fuel Cell Operates. Compares the fuel cell with the ordinary battery, discusses fuel cell efficiency, kinetics, and costs. A hydrogen-oxygen fuel cell, an ion-exchange membrane fuel cell, regenerative fuel cells—the redox and the converter are discussed. ***L. D. McGraw.*** *SAE Journal*, v. 68, Dec. 1960, p. 74-79.

HUMAN FACTORS

* **Acoustic Noise, An Informational Definition.** Proposes a definition relating acoustic noise to its environmental source and the informational content of the specific task in which it occurs. ***Alan A. Burrows.*** *Human Factors*, v. 2, no. 3, Aug. 1960, p. 163-168.

* **Threshold and Rate of Dark Adaptation as Functions of Age and Time.** Presents a mathematical derivation of a model for representing dark adaptation as a function of age and time. Results show that rate of dark adaptation is a curvilinear function of age. ***Richard G. Domey, Ross A. McFarland, and Ernest Chadwick.*** *Human Factors*, v. 2, no. 3, Aug. 1960, p. 109-119.

* **Human-Factors Engineering.** Discusses techniques for analyzing human performance in man-machine systems. ***H. L. Williams.*** *Industrial Research*, v. 2, no. 5, Oct.-Nov. 1960, p. 36 + 5 pages.

INFORMATION—PREPARATION AND DISSEMINATION

Engineering Library Costs. The initial period of a company engineering library is the most expensive—the least profitable. However, this kind of library can pay off handsomely, particularly in literature searches. Shows how much it costs to start a library, and what it takes to keep it going. ***Harold S. Sharp.*** *Machine Design*, v. 32, Oct. 27, 1960, p. 108-111.

* **Communication—"Unpublished" Information.** Considers the special case of biomedical information, which is considered unpublished, even though printed, if it has not appeared in the conventional scientific periodicals, monograph series, etc., issued by the various scientific societies and commercial publishers. ***Richard H. Orr.*** *Industrial Science and Engineering*, v. 8, no. 1, Oct. 1960, p. 7-11.

* **Review of Studies in the Flow of Information Among Scientists. v. I. Text. v. II. Tables.** Reviews completed studies of the behavior, habits, usages, experiences, and expressed needs of research scientists with regard to the obtaining of available scientific information. v. I. 62 pp. v. II. 48 pp. Jan. 1960. Bureau of Applied Social Research, Columbia University, New York. (Q181 C72.7r Over.)

The Termatrex Inverted "Punched Card" Systems. A detailed description of the Termatrex system, marketed by the author, is presented, together with the theory upon which it is based. The system is a variant of the Peek-a-Boo technique with mechanical refinements. ***Frederick Jonker.*** *American Documentation*, v. 11, no. 4, Oct. 1960, p. 305-315.

A Checklist for the Organization, Operation and Evaluation of a Company Library. Planned for the use of nonlibrarian management as well as administrators of libraries. Intended for handy reference in making decisions, such as planning a company library where none exists or evaluating one already in operation. ***Eva Lou Fisher.*** 60 pp. 1960. Special Libraries Association, New York. (Z678 F53c)

The Hungarian State Technical Library (OMK): Its Role in Coordinated Hungarian Scientific Documentation. Presents a detailed description of documentation activities in Hungary with particular emphasis upon the work of the Hungarian State Technical Library. ***Elizabeth Beyerly.*** *American Documentation*, v. 11, no. 4, Oct. 1960, p. 296-304.

Engineering Documentation: Redstone. A report is given on the microfilming system developed at the U. S. Army Rocket and Guided Missile Agency to handle 2,350,000 engineering drawings and related documents. ***Harry E. Patterson.*** *Graphic Science*, v. 2, Dec. 1960, p. 13-17.

* **In Chinese Libraries.** Describes both public and special libraries in the Chinese People's Republic. Special emphasis is given to the Library of the Academy of Sciences and the Peking State Library. ***A. Rafikov.*** *Special Libraries*, v. 51, no. 10, Dec. 1960, p. 527-532.

Keyword-In-Context for Technical Literature. A distinction is made between bibliographical indexes for new and past literature based on the willingness of the user to trade perfection for currency. Indexes giving keywords in their context are proposed as suitable for disseminating new information. These

can be entirely machine-generated and hence kept up-to-date with the current literature. A compatible coding scheme to identify the indexed documents is also proposed. ***H. P. Luhn.*** *American Documentation*, v. 11, no. 4, Oct. 1960, p. 288-295.

Correlative Indexes VI: Serendipity, Suggestiveness, and Display. Discusses literature searches of recall (i.e., of known products, ideas, etc.) and searches of discovery, where the product or idea is thought to be new. Displays of symbols are needed to lead the searcher to new information since he cannot adequately predict new research results or their dates and places of publication. Better displays of suggestive symbols are needed for generic searches then are provided by current classifications and indexes. Dynamic classifications that grow with new knowledge, e.g., current thesauruses, seem to be indicated. ***Charles L. Bernier.*** *American Documentation*, v. 11, no. 4, Oct. 1960, p. 277-287.

* **Sources of Metallurgical Literature in the Soviet Union.** In its general features, the metallurgical literature in the Soviet Union is similar to that the U. S. Differences are largely a matter of degree or emphasis; for example, there is a greater tendency in the Soviet Union to specialize sharply according to ferrous versus nonferrous metallurgy and to supply highly individualized service. ***Albert G. Guy.*** *Special Libraries*, v. 51, no. 10, Dec. 1960, p. 532-536.

* **The Expanding Network of Engineering Libraries in the Soviet Union.** The basis for the currently expanding system of engineering libraries is the recent division and subdivision of the USSR into economic regions and economic administrative districts. The new engineering library network, giving direct support to science and technology on a broad territorial basis, is an important aspect of the Soviet challenge. ***Thomas J. Whitby.*** *Special Libraries*, v. 51, no. 10, Dec. 1960, p. 537-539.

Effective Technical Reporting. Four articles by specialists. ***Kathryn O'Keeffe, John A. Walter, Charles H. Vervalin, and Rosewell Atwood.*** *Petroleum Refiner*, v. 39, Dec. 1960, p. 109-128.

INSTRUMENTATION

Crossed Electric and Magnetic Field Multichannel Ion Analyzer. A multichannel mass and energy analyzer using crossed electric and magnetic fields for ion separation has been constructed to analyze plasmas produced in conjunction with a magnetic mirror machine. Ions are piped between the strong magnetic field of the mirror machine and the weaker magnetic field of the analyzer by auxiliary magnetic coils, and they enter the analyzer traveling in a direction nearly parallel to the magnetic field. There, the ions are accelerated by the electric field and assume cycloid-like trajectories in the plane perpendicular to the magnetic field. The ions are collected by detectors located at the top of the cycloid. The amplitude of the cycloid is determined by the e/m of the ion; the distance traversed parallel to the magnetic field before collection is proportional to the velocity of the ion. ***L. Evan Bailey.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1147-1152.

Counter Torque Quartz Fiber Adaptation of the Curie-Chéneveau Type Magnetic Balance. A mechanically simple magnetic balance having sufficient sensitivity to measure diamagnetic susceptibilities was developed using a permanent magnet. Its operation is based on the twisting of a quartz or Vycor fiber in a direction such as to overcome the effects of the magnetic field. The magnetic field strength is dependent on the position of the magnet with respect to the sample and can be varied by using different magnet settings. ***M. C. Day, L. D. Hulett, and D. E. Willis.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1142-1145.

Temperature Control Method for Use Between 4.2° and 77°K. A simple system is described for maintaining controlled experimental temperatures between the normal boiling points of He and N. No special apparatus is involved other than that normally required for the handling of liquid He and the measurement of low temperatures. The technique has been used to control the temperature of a resonant cavity to within ±0.2 K, for $T > 20$ K, using a copper-Constantan thermocouple and a variable range recording potentiometer to measure temperature. ***John M. Flournoy, Lillian H. Baum, and Seymour Siegel.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1133-1135.

Small General Purpose Double Focusing Mass Spectrometer. A small high performance double focusing mass spectrometer employing a 90° electrostatic analyzer and a 60° magnetic analyzer is described. The radius of curvature of ion paths in the magnetic analyzer is 2 in. As a laboratory instrument for making gas or isotope analyses, its sensitivity and resolution make it competitive with instruments several times as large employing only a magnetic analyzer. With a permanent magnet the weight and power consumption are both low, making it attractive for applications where these factors may be of importance. ***Alfred O. Nier.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1127-1132.

Punched Tape Readout for a Multichannel Pulse-Height Analyzer. An instrument for transferring information from a magnetic core memory to punched paper tape is described. When used with a 100-channel pulse-height analyzer with a capacity of 10^6 counts per channel, total readout time for all 100 channels is less than 17 sec. ***Jack Brotzman.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1073-1076.

Transistor Switch Stimulus Isolator. The instrument described provides rectangular pulses separated from ground by less than 20 pf capacity and essentially infinite resistance. The transistor switch provides pulses at low output impedance, from a floating battery, of 0 to 80 v in amplitude and variable in duration by the width of a triggering stimulus from a conventional stimulator or pulse generator. The device is of particular use in biological experiments where isolation of a stimulating pulse from ground is required. ***H. Fein.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1070-1072.

Analysis of a Magnetic Resonance Spectrometer. Analyzes an electron paramagnetic resonance microwave bridge spectrometer, and expressions are given for the relation between the signal and the imaginary part of the magnetic susceptibility. From these the conditions for maximum signal are obtained. The analysis is also applicable to many other types of magnetic resonance spectrometers. ***J. P. Goldsborough and M. Mandel.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1044-1046.

* **The Use of Alumino-Silicate Glasses in Experimental Vacuum Devices.** Development of techniques for using the alumino-silicate glasses with conventional glassblowing methods to make experimental vacuum tubes that withstand at least a 600 C air bakeout. ***George W. Hees and Kenneth D. Earley.*** *Sylvania Technologist*, v. 13, no. 4, Oct. 1960, p. 148-150.

* **Finishing Pointers.** How current efficiencies affect solution control. ***Edward F. Duffek.*** *Metal Finishing*, v. 58, Oct. 1960, p. 71.

Ultrarapid-Scan Infrared Spectrometer. A simple low-resolution rapid-scanning infrared spectrophotometer has been developed from a modified commercial monochromator. When used with a cooled InSb or some other very fast response detector, this spectrometer is capable of over 20,000 scans per sec, as limited by the present drive motor. A raster-type oscilloscope recording system is described which allows the photographic observation of many spectral scans on one oscilloscope. Sample emission spectra are shown of a Xe reflected shock and a Xe flash lamp. ***George W. Bethke.*** *Optical Society of America, Journal*, v. 50, Nov. 1960, p. 1054-1057.

* **The Calibration of the Weights Built Into a Balance.** A description is given of a method which facilitates the calibration of the weights built into balances provided with mechanical means for changing the weights. The method does not require the removal of the weights from the balance. Some criteria are established for the purpose of selecting a satisfactory built-in weight system, and three systems which satisfy the criteria are included. ***J. W. Humphries.*** *Australian Journal of Applied Sciences*, v. 2, no. 3, Sept. 1960, p. 360-373.

Chemical Techniques for the Investigation of Surfaces. A microcatalytic technique in which studies are made with very small amounts of reactant and catalyst is discussed. Applications of this technique to studies of catalytic activity, both steady and

non-steady state, are reviewed and some obvious extensions are noted. Tracer investigations aimed at the study of the nature of the surface itself are also discussed. ***R. J. Kokes.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 51-55.

* **Improvements on a Mass Spectrometer for Organic Structure Analysis.** The construction of the ion source, analyzer tube and collector is described in detail, and circuit diagrams of the different electronic systems of the instrument are given. ***Ragnar Ryhage.*** *Arkiv för Kemi*, v. 16, nos. 1-2, 1960, p. 19-49.

Dual-Inlet System for a Mass Spectrometer. ***G. L. Cook, R. A. Meyer, and D. G. Earnshaw.*** *U. S. Bureau of Mines Report of Investigations* 5663, 1960, 8 pp. (TN21 Un3r Room 290)

* **The Theory and Operation of the Rotating Crystal Slow Neutron Chopper.** The resolution and efficiency of the rotating crystal chopper are derived theoretically as a function of the crystal and collimator parameters. It is shown that the limiting resolution of the device is the same as that of a crystal monochromator. An experimental model chopper is described and its observed resolution compared with the theory. ***D. A. O'Connor.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 244-248.

An Apparatus for Measurement of the Surface Area of Irradiated Coarse Powders. An apparatus was designed for determining the surface area of highly radioactive coarse particles. The system used krypton as the adsorbate and a thermistor manometer to measure pressures. Measurements were made on samples with areas as low as 50 cm^2. The design, construction, and precision of the system are discussed. ***F. D. Leipziger and L. A. Altamari.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 312-314.

Apparatus for the Measurement of Gas Velocity in Furnaces and Models. A range of Pitot tubes is described together with an electromagnetic transducer micromanometer. The assembly is designed for the measurement of gas velocity over a large range of temperature, and pollution with velocities as low as 40 cm/s. ***A. E. Pengelly.*** *Journal of Scientific Instruments*, v. 37, Sept. 1960, p. 339-346.

* **High-Efficiency, Long-Lived Vacuum Cold Trap.** The construction and performance of a vacuum cold trap for pump oil, "O"-ring, and other vapors are described. The trap has a capacity of 16 liters of liquid N, and lasts five days on one filling when clean. After a period of about six months to one year of continuous use, the lifetime has dropped to about three days. The trap has high pumping speed, and very high trapping efficiency, requiring a minimum of three successive cold-surface collisions for a molecule migrating through the trap. ***J. W. Butler.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 211-216.

* **An Instrument Facilitating the Measurement of Small-Angle Scattering in Nuclear Emulsion.** The assembly of components constituting the instrument is described. Special attention is paid to the essential features. The wiring diagrams are given. The experience obtained with the instrument in the first months of operation classifies it as a satisfactory new tool in nuclear physics. The principle underlying the instrument can be extended to bubble-chamber film. ***A. G. C. Tenner, B. Jongejans, and H. Witteveld.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 221-224.

* **A Low Background Beta Counter With a Plastic Scintillator Anticoincidence Shield.** The design and performance of a low background beta counter is described. The counter consists of a central gas flow proportional counter surrounded by a large plastic scintillator anticoincidence shield. ***J. R. Gat (Gutmann) and J. Gilat.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 233-235.

Threshold Sensitivity of Radiation Receivers. The relationship of the sensitivity threshold of radiation receivers, as determined by the fluctuations in the effectively absorbed quanta, to the magnitude of the steady background and certain properties of the receiver-amplifier-indicator system is considered. ***E. S. Ratner.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 52-55.

* **A Laboratory Apparatus for the Continuous Production of Uniform Droplets.** The development, liquid feed, droplet diameter control, velocity of droplets, target movement, disadvantages and uses are discussed. ***R. C. Amsden.*** *AVC, Agricultural & Veterinary Chemicals*, v. 1, no. 3, Sept.-Oct. 1960, p. 139-140.

a

Microrgy. Although this technique for investigating and operating on single living cells has been employed since the beginning of the century, it is still in its infancy. It should yield increasingly valuable information as skill improves in the making and use of microinstruments. ***M. J. Ord.*** *New Scientist*, v. 8, Oct. 20, 1960, p. 1049-1051.

b

* **Magnetic Probes of High Frequency Response.** Probes for the measurement of the magnetic field distribution in fast pulsed discharges have been constructed. Their frequency response has been measured and agrees well with that calculated from an equivalent circuit. The probes described have an attenuation flat (to within 1%) up to 20 Mc/s. A criterion is given which states the optimum value for the impedance of the recording circuit. ***S. E. Segre and J. E. Allen.*** *Journal of Scientific Instruments*, v. 37, Oct. 1960, p. 369-371.

c

Electronic Apparatus for the Study of X-Rays With Proportional Counter. The design and construction of an electronic pulse recording system for use with a proportional counter suitable for X-ray studies is described. The performance of the high gain amplifier and pulse amplitude analyzer for X-ray wavelength discrimination is discussed in detail. ***N. Patla.*** *Journal of Scientific Instruments*, v. 37, Oct. 1960, p. 388-393.

d

Transformer Bridges for Use With Resistance Strain Gauges and Similar Transducers. The long-time stability and accuracy of reading can be readily made better than required for most static testing by the use of an auxiliary transformer. The bridge can be combined with a commercial potentiometric recorder to form a multi-channel self-balancing a.c. bridge which can provide different ranges on successive channels. ***L. N. Clarke.*** *Journal of Scientific Instruments*, v. 37, Oct. 1960, p. 381-384.

e

* **Instrumentation of a Pilot Plant.** This article describes some problems associated with the instrumentation of a pilot plant for a pressurized slagging coal gasifier, involving a process for the conversion of low-grade coal into gas. ***S. Brodnicki.*** *Chemical & Process Engineering*, v. 41, Nov. 1960, p. 492 + 7 pages.

f

Testing Elevated Temperature Structures. Resistance heating and heating with quartz lamps are two methods being used to great advantage for the testing of structures subjected to elevated temperatures. ***S. L. Shaw and C. H. Stevenson.*** *SAE Journal*, v. 68, Dec. 1960, p. 56-58.

g

* **The Present Stage of Ultra-High Vacuum Technique.** The ultra-high vacuum zone includes pressure zones below 10^{-7} Torr. The recipient surfaces are kept very clean. Hr oil-diffusion pump is used for the obtaining of the required pressure. (*In German.*) Der heutige Stand der Ultra-Hochvakuumtechnik. ***K. Diels.*** *Vakuum-Technik*, v. 9, no. 7, Oct. 1960, p. 191-195.

h

* **Instrumentation Magnetic Recording.** Surveys the general field of instrumentation magnetic recording. The individual requirements for analogue and digital recorders are examined and the influence of these requirements on mechanical design, electronic equipment and magnetic tape is illustrated. ***P. E. Axon.*** *British Institution of Radio Engineers, Journal*, v. 20, Oct. 1960, p. 723-734.

i

Shipborne Inertial Navigation Systems. The two basic instruments used for inertial navigation are the accelerometer and the gyroscope, and this article describes them and how they are applied to ship-borne inertial navigation systems. ***H. T. Heal.*** *Research Applied in Industry*, v. 13, Nov. 1960, p. 453-460.

j

* **A Monochromator for the Vacuum Ultra-Violet.** The design and construction of a monochromator suitable for photoelectric spectrophotometry and photo-ionization studies at short wavelengths is described. It incorporates a device for moving the exit slit along the beam to keep the spectrum in focus as the grating is rotated. The tank is divided transversely into two

k

sections for permitting easy adjustment or interchange of gratings without disturbing the driving mechanism. A variety of attachments are described. ***L. D. Isaacs, W. C. Price, and R. G. Ridley.*** *Optica Acta,* v. 7, no. 3, July 1960, p. 263-270.

a

* **New Infra-Red Detectors for the 1 to 7 Micron Region.** Brief theoretical results are given, showing the dependence of the sensitivity of solid-state detector utilizing the photoconductive and photoelectromagnetic effects on material parameters. In the light of these results, the applicability of two materials, indium arsenide and indium antimonide, is discussed and the construction and performance of detectors made from these materials are described. ***D. H. Lee and D. H. Roberts.*** *Optica Acta,* v. 7, no. 3, July 1960, p. 271-280.

Instrument for the Measurement of Specular Reflectivity of Bright Metal Surfaces. A simple modification of the gloss head for painted surfaces, described in Defence Specification DEF/1053, enables it to be used for the measurement of the surface quality of bright anodized Al in terms of specular reflectivity. The instrument has a high sensitivity. ***B. A. Scott.*** *Journal of Scientific Instruments,* v. 37, Nov. 1960, p. 435-438.

Lens Mass-Spectrometer Leak Detector. A new mass-spectrometer leak detector was investigated, based on the use of an iron-shrouded axially symmetrical magnetic lens for focusing ions in the low mass range. By taking precautions to keep the H background at a low and stable level, it was possible to use H as a search gas. ***D. Cossutta and W. Steckelmacher.*** *Journal of Scientific Instruments,* v. 37, Nov. 1960, p. 404-410.

Low-Compliance Diaphragm-Capacitance Gauge for Measurement of Liquid Pressures of the Order of 1 in. Water. The construction of a compact "diaphragm-capacitance" gage suitable for pressure measurement in viscous liquids is described. Sensitivities in the range 1 to 12pF/in. water are obtained by using different diaphragm units. ***A. S. Lodge.*** *Journal of Scientific Instruments,* v. 37, Nov. 1960, p. 401-403.

LUBRICATION AND FRICTION

Infrared Studies of Greases. Studies of infrared absorption of greases are shown to yield valuable information concerning the grease thickeners and additives used in grease formulation. Results of the study of a series of metallic laurate soaps were applied to the examination of the infrared absorption spectra of an aluminum-soap grease, a calcium-complex grease, a lime-base grease, a lithium-soap grease, and a soda-base grease. Infrared spectra revealed structural changes in the processing of calcium-acetate complex greases. ***S. E. Wiberley, W. H. Bauer, and D. B. Cox.*** *NLGI Spokesman,* v. 24, no. 8, Nov. 1960, p. 328-333.

Rolling Bearing Performance Test for Lubricating Greases. Development, design, and operation of test rig. *Institute of Petroleum, Journal,* v. 46, Oct. 1960, p. 328-333.

Surface Re-Orientation, Friction and Wear, in the Unidirectional Abrasion of Graphite. A study of abrasion of graphite by emery papers of particle diameter of 5 to 150 microns. Electron diffraction shows that the abrasion causes a reorientation of the graphite at and near the surface by plastic flow by slip on (0001). A method of comparing the hardnesses of the work-hardened surface regions of abraded materials in terms of abrasion-groove widths is described. ***P. V. K. Porgess and H. Wilman.*** *Physical Society, Proceedings,* v. 76, pt. 4, Oct. 1960, p. 513-525.

Characteristics Governing the Friction and Wear Behavior of Refractory Materials for High-Temperature Seals and Bearings. An investigation of the basic factors involved in the wear and friction of ceramics, cermets, and high-temperature alloys sliding at speeds of 100 to 200 fps and temperatures from 500 to 1000 C (1000 F to 1800 F) has been made. Bearing pressures covered a range of 5 to 50 psi. Statistical correlation of measured wear rates with friction and material properties indicates that, at these temperatures, the wear rate of ceramics and cermets is proportional to $\mu/R^{1.25}D^{0.75}$, where

μ is the coefficient of friction, R is the thermal-stress-resistance factor, and D is the thermal diffusivity of the material on which wear predominates, which is usually the material with the lowest thermal-stress resistance. Promising commercial materials for high-temperature dry sliding bearings, gas bearings, and seals include Al_2O_3-Cr-Mo cermets, SiC ceramics, and TiC-Ni-Mo cermets. ***Lewis B. Sibley, Arthur E. Mace, Daniel R. Grieser, and C. Malcolm Allen.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 60-54, May, 1960, 47 pp. (TL507 Un3.18w Vis.)

b

Extreme Pressure Lubricants for Marine Gears. An extreme pressure oil may be used where the design *per se* requires a higher load-carrying capacity than that provided by a normal oil and where its use will afford insurance against trouble. ***A. D. Newman.*** *Institution of Mechanical Engineers, Proceedings,* v. 174, no. 5, 1960, p. 241-246.

c

* **Investigation of Lubricating Oils in Two-Stroke Gasoline Engines. I.** The general problems connected with the lubrication of the two-stroke gasoline engines are presented. Studies were made of the effect of lubricating oils on the resistance of gasolines to compression. (*In Russian.*) Ispytanie smazochnykh masel dlia dvukhtaktnykh benzinovykh dvigatelei. I. ***L. Vajta.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 24, no. 1, 1960, p. 19-30.

d

On the Compressibility Effects of the Lubricant for Two-Dimensional Slider Bearings. By the variational method, it is shown that, for a given bearing length, no optimal film shape of the bearing can be found to yield a maximum total load. Analysis of the numerical results carried out for stepped films with a compressible lubricant under isothermal compression or expansion indicates that this anomaly is due to the nonlinear nature of the compressible problem. By considering a modified variational problem, it is further shown that stepped-film bearings with isothermal lubricant still yield the maximum total load for a given mass flow rate passing through the bearings, but the exact shape of the optimal stepped film is found to depend on the value of the maximum pressure. ***K. T. Yen.*** *ASME, Transactions, Series E, Journal of Applied Mechanics,* v. 27, no. 4, Dec. 1960, p. 609-612.

e

f

* **High-Temperature Bearing Properties and Cobalt-Base Alloys.** The specific requirements of high-temperature bearing properties seem to be met by cobalt alloys. What seems to be lacking is a systematic investigation of the various high- temperature cobalt-base alloys under actual bearing conditions. There is also little mention in the literature of development of cobalt-base alloys specifically for high-temperature bearing use. On the basis of the present literature survey, there are strong indications that cobalt-base alloys may be developed into bearing materials having outstanding properties. ***M. F. Amateau.*** *Cobalt,* no. 9, Dec. 1960, p. 27-33.

g

* **Evaluation of Long-Chain Phosphorus Compounds as Lubricity Additives.** Two and 5% blends of a series of new long-chain phosphates and phosphonates were examined for suitability as lubricity additives in bis(2-ethylhexyl) sebacate and mineral oil. The most effective anti-wear agents were diethyl stearoxyethyl-, dibutyl lauroxyethyl-, and di(2-ethylhexyl) lauroxyethyl-phosphonate and dibutyl lauroxypropyl phosphate; the most promising extreme pressure agents were di(2-ethylhexyl) lauroxyethyl phosphonate, diethyl oleoxyethyl, diethyl oleoxybutyl, and dibutyl lauroxypropyl phosphates. ***Louise F. Peale, et al.*** *ASLE Transactions,* v. 3, no. 1, Apr. 1960, p. 48-54.

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Mechanical Wear. Principles of wear testing; selected experimental investigations; theories and laws of wear; corrosive wear and the influence of temperature; wear prevention or reduction. ***G. W. Rowe.*** *Applied Mechanics Reviews,* v. 13, Nov. 1960, p. 787-790.

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MECHANICAL ENGINEERING

A New Method for Designing Cams for Analog Computers. Charts are presented for the design of cam mechanisms to match either a known function or empirical data. The charts permit the selection of a ratio of center distances to follower-

k

arm length, and define the corresponding range of pressure angles. Follower-roller diameter can be selected to avoid undercutting, other dimensions can be proportioned, and pressure angles at the beginning and end of cam rise can be adjusted for optimum conditions. ***Charles Eumurian.*** *Machine Design*, v. 32, Oct. 27, 1960, p. 145-155.

* **The Deformation of Elastic Circular Rings.** A straight, flexible strip is bent into the form of a circular ring and subjected to two equal and opposite radial forces. The discussion is restricted to deformations in the initial plane of the ring. The analysis shows that the elastic line of the deformed ring is always a segment of the nodal or of the undulating elastica. Coordinates corresponding to different values of the load are given and the method is explained by a numerical example. ***R. Frisch-Fay.*** *Australian Journal of Applied Science*, v. 2, no. 3, Sept. 1960, p. 329-340.

* **The Flexible Leaf Spring.** Two circular leaf springs facing each other are connected by hinges at their ends and are acted upon by two equal and opposite forces placed symmetrically. The discussion shows that the elastic line of the deformed spring can be replaced by segments of the nodal or of the undulating elastica. Formulae for the coordinates of the elastic line under different loads are given and the method is explained by a numerical example. ***R. Frisch-Fay.*** *Australian Journal of Applied Science*, v. 2, no. 3, Sept. 1960, p. 341-352.

* **Elastic Behaviour of Matter Under Very High Pressures. I. General Deformation. II. Simple Shear.** Deals with the study of the elastic behavior of substances which are initially subjected to a finite simple shear. Expressions are derived for the effective elastic constants in the case of a substance of cubic symmetry. I. ***S. Bhagavantam and E. V. Chelam.*** II. ***E. V. Chelam.*** *Indian Institute of Science, Journal*, v. 42, no. 3, July 1960, p. 29-46.

Practical Design of Sheet Metal Stampings. ***Federico Strasser.*** 175 pp. 1959. Chilton Co., New York. (TS250 St81p)

* **Photoelastic Measurement of Surface Strain. III.** Investigation of a direct method using an optically sensitive material bonded to the metal component. ***J. R. Linge.*** *Aircraft Engineering*, v. 32, Oct. 1960, p. 295-298.

Design Guide: Stainless Honeycomb Panels. Brazed honeycomb panels have become the most sophisticated structural elements in modern high-speed air-craft. Gives the basics of design, with emphasis on materials and practical details of construction. ***D. Y. Potter.*** *Product Engineering*, v. 31, no. 50, Dec. 5, 1960, p. 67-72.

The Mechanics of Vibration. Introductory problems, generalized co-ordinates and Lagrange's equations, systems having any finite number of degrees of freedom, the taut string, the analysis of real systems, approximate methods, torsional and longitudinal vibration of uniform shafts and bars, flexural vibration of uniform beams, viscous damping, hysteretic damping, free vibration, non-harmonic and transient vibration are discussed. ***R. E. D. Bishop and D. C. Johnson.*** 592 pp. 1960. Cambridge University Press, New York. (QA935 B54m)

Free, Transverse Vibrations of a Solid Elastic Mass in an Infinitely Long, Rigid, Circular-Cylindrical Tank. Making use of the field equations of elasticity, a frequency equation is derived which relates the natural circular frequencies and Poisson's ratio. This relationship is plotted, revealing a very interesting step-like variation of the natural frequency with Poisson's ratio. Displacement fields are plotted for two natural frequencies in each of the first three modes. ***J. H. Baltrukonis.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 663-668.

* **Thermal Stresses in an Elastic, Work-Hardening Sphere.** A method is presented for obtaining the transient thermal-stress distribution and the residual stresses in a spherical body where the time-dependent temperature distribution is symmetrical with respect to the center of the sphere. The material is assumed to be elastoplastic, while in the plastic range it work-hardens isotropically. The von Mises yield condition is used. The thermal and mechanical properties of the material are assumed to be temperature independent. The problem is reduced to a single

nonlinear differential equation which is solved numerically on the NCR 304 digital computer. Several sets of numerical data representing various degrees of work-hardening in the spherical bodies during a cooling process are presented. ***Chintsun Hwang.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 629-634.

Thermal Stresses Due to Disturbance of Uniform Heat Flow by an Insulated Ovaloid Hole. The linear thermoelastic problem is solved for a uniform heat flow disturbed by a hole of ovaloid form, which includes the ellipse and circle as special cases. Results for stress and displacement are found in closed form, by reducing the problem to one of boundary loading solvable by a method of Muskhelishvili. ***A. L. Florence and J. N. Goodier.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 635-639.

Vibrations of Elastic Sandwich Cylindrical Shells. Previous treatment of the subject is extended to the vibration study of sandwich cylindrical shells. General theory is developed. Simplified equations are applied to the investigation of axially symmetric and torsional vibrations. ***Yi-Yuan Yu.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 653-662.

Recent Developments in Elastic Wave Propagation. Extended information exists now on frequency equations governing compressional, flexural, and torsional waves in an infinite elastic rod, plate, and cylindrical shell. Recent efforts have established the character of the higher real branches of the frequency spectrum (real frequency versus real wave number) and associated harmonic waves in these cases. The existence and character of the imaginary and complex branches of the spectrum (real frequency versus imaginary and complex wave numbers) and their waves, in the cases of compressional and flexural waves in the rod and plate, have also been established. ***Julius Miklowitz.*** *Applied Mechanics Reviews*, v. 13, Dec. 1960, p. 865-878.

The Elastic Half Plane Subjected to Surface Tractions With Random Magnitude or Separation. First- and second-order moments of the stress tensor are obtained for the elastostatic problem concerning the half-plane subjected to random boundary tractions. The cases treated include the following types of applied surface tractions: a purely random Gaussian load (white noise); concentrated loads of random magnitudes separated by equal intervals; a concentrated load acting at a random location; and concentrated loads of equal magnitudes separated by random intervals. ***A. C. Eringen and J. W. Dunkin.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 701-709.

On a Class of Nonlinear Axisymmetric Plate Problems. The validity of the classical treatment of problems involving axisymmetric plates, partially constrained from deflection by the presence of a smooth, rigid, plane surface, is re-examined, and both the practical and conceptual advantages of carrying the analysis within the scope of the E. Reissner plate theory are illustrated by means of an example. ***F. Essenburg.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 677-680.

Flexural Stress Waves in an Infinite Elastic Plate Due to a Suddenly Applied Concentrated Transverse Load. A solution is derived from a plate theory that incorporates, in addition to bending, the effect of shear force and rotatory inertia on the deflection. These added effects give the present theory true-wave character, along with greater accuracy in the waves predicted. Numerical evaluation of the solution brings out the effects of dispersion and distortion on the moment and shear-force response of the plate. A criterion is developed for judging the accuracy of this response. It is based on a comparison, employing the stationary phase method, of the present approximate and exact (three-dimensional) theories. ***Julius Miklowitz.*** *ASME, Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 681-689.

Plastic Analysis of Circular Conical Shells. A right circular conical shell of edge angle α is subjected to a concentrated load Q directed along the axis. The collapse load is found to be $Q = 2\pi M_0 \cos^2 \alpha$, independent of the size or support conditions of the shell. Some solutions are also obtained for the case where the load is distributed over a finite area. Bounds are found on the collapse load of a general rotationally symmetric shell under

a concentrated load. ***P. G. Hodge, Jr.*** *ASME Transactions, Series E, Journal of Applied Mechanics*, v. 27, no. 4, Dec. 1960, p. 696-700.

METALLURGY

Creep-Resistant Magnesium Alloys for Nuclear Fuel Elements. An investigation has been made of the creep properties at 450-500 C of extruded Mg-base Mg-Mn and Mg-Zr-Mn alloys with a view to their application as lightly stressed structural components. Binary alloys containing 0.75-1.0% Mn (AM503S) exhibit a high creep strength at low stresses only if submitted to a grain-coarsening treatment. This, however, results in poor rupture ductility; at higher stresses a better ductility, accompanied by a marked loss in creep strength, is found. When the manganese content is raised to 1.5% (AM503), a very high creep-resistance at 450 C is obtained in the as-extruded condition, at a relatively small grain size. In ternary alloys containing 0.2-0.7% Zr, 0.1% Mn imparts high creep strength at 450 C, but results in a relatively poor creep strength at 500 C, which cannot be substantially improved by heat-treatment. A 0.3% Mn content imparts high creep-resistance at 500 C, the best alloy being that containing 0.7% Zr. At high temperatures, the ternary alloys possess a relatively stable grain size and high rupture ductility. ***G. C. E. Olds and G. M. Michie.*** *Institute of Metals, Journal*, v. 88, pt. 12, Aug. 1960, p. 493-499.

Aluminium Bar Casting and Rod Rolling. A combined casting and rolling unit for the production of conductor-grade Al rod is described. Molten Al from an induction furnace is fed, via a holding furnace, to a horizontal casting unit from which 2¼-in.-dia. bar is continuously withdrawn; this is cut into 30-ft lengths, reheated, and hot rolled to ⅜-in. dia. An important feature of the casting process is the vacuum applied at the exit end of the mold. ***A. H. Tessmann.*** *Institute of Metals, Journal*, v. 89, pt. 2, Oct. 1960, p. 48-51.

Low-Temperature Metals: A Roundup. Compares the common metals in cryogenic service today. Discusses the superinsulations that help contain ultralow temperature fluids, and describes some pieces of cryogenic equipment. ***George H. Zenner.*** *Chemical Engineering*, v. 67, Oct. 31, 1960, p. 117-120.

Study of Gases in Metals. A Literature Survey. Structure and phase diagrams, thermodynamic data, disposition of gases in the metal and effect of dissolved gases on physical properties, gas removal by vacuum annealing, and selected oxidation reduction reactions for Nb and Ta are discussed. ***J. P. Pemsler.*** *U. S. Atomic Energy Commission, NMI-9800*, Aug. 17, 1959, 51 pp. (UF767 Un3.1nm Contin.)

* **The Use of Wire for Screens.** Wire analysis for screens, screen wear, and the transition from wire to a high-grade screen are discussed. ***Erich O. Riedel.*** *Wire*, no. 49, Oct. 1960, p. 194-200.

Cobalt Monograph. Comprehensive review of history, occurrence, mining and milling, extractive metallurgy, economics, physical and mechanical properties, chemistry, and use of Co in alloy systems, high-temperature alloys, magnetic materials, tool and die steels, cemented carbides, hardfacing and wear-resisting alloys, coatings, glass and ceramics, agriculture, catalysts, driers, and pigments. Includes medical aspects of Co and industrial uses of radioisotopes. ***E. Ellis Fletcher, et al.*** Centre D'Information Du Cobalt, Brussels, Belgium. 515 pp. 1960. Available from M. Weissenbruch S.A., 49 rue du Poincon, Brussels, Belgium. (QD181.C6 C63c)

* **Metallurgy Since the Beginning of the Century. Some Features in Its Progress.** ***Anton Grönningsäter.*** *Canadian Mining Journal*, v. 81, Nov. 1960, p. 82-89.

METALS—CORROSION

* **The Resistance of Welded Titanium Pipes in Hydrochloric Acid Saturated With Chlorine.** Welded equipment and pipes of Ti of the VTl grade can be used for work in a hydrochloric acid medium, especially for chlorination processes. With 5% HCl the temperature must not exceed 90 C; with 20% HCl the temperature must remain below 60 C in the presence of free Cl with about 0.2 g/100 ml of the acid. (*In Russian.*) Stoĭkost svarnykh titanovykh trub v solianoĭ kislote, nasyshchennoĭ khlorom. ***A. T. Koniushenko and R. V. Golovkin.*** *Avtomaticheskaia Svarka*, v. 13, no. 10(91), Oct. 1960, p. 67-71.

The Oxidation of Copper. A Review of Published Data. A review of published papers with emphasis on work done in the last decade. Experimental techniques and theoretical rate laws are discussed. Oxidation isotherms in the range 18-1020 C show that for data obtained at high temperatures there is good agreement between the various investigators, but that at lower temperatures the agreement is poor. At low temperatures quasi-logarithmic oxidation seems to prevail; over an extended range of intermediate temperatures, oxidation ranges from cubic to parabolic, while at high temperatures the parabolic law is generally obeyed. Single-crystal work on Cu is reviewed with respect to oxidation rate and orientation of the oxide layer on different crystal faces. Information on the composition of the oxide layer has been compiled. Studies of the morphology of the oxide reveal whisker growth and nucleation phenomena in the oxidation of Cu. ***A. Rönnquist and H. Fischmeister.*** *Institute of Metals, Journal*, v. 89, pt. 2, Oct. 1960, p. 65-76.

The High Temperature Oxidation of Beryllium. II. The Reaction With Carbon Dioxide and With Carbon Monoxide. ***S. J. Gregg, R. J. Hussey, and W. B. Jepson.*** *Journal of Nuclear Materials*, v. 2, no. 3, Sept. 1960, p. 225-233.

* **Study of the Degree of Passivity of 18-8 Stainless Steels. Special Electrochemical Behavior of 18-8 Molybdenum Steel.** Depassivation of 18-8 stainless steel in H_2SO_4 by a weak cathodic current allows determination by coulometry of the degree of passivation for specimens subjected to various passivating treatments. The method is not applicable to the 18-8 Mo steel; its electrochemical properties in H_2SO_4 differ widely from those of ordinary 18-8, as is shown by comparison of polarization curves plotted by a potentiostatic method. (*In French.*) Etude du degré de passivité des aciers inoxydables 18-8. Comportement électrochimique particulier du 18-8 au molybdène. ***Philippe Berge.*** *Revue de Métallurgie, Mémoires Scientifiques*, v. 57e, no. 9, Sept. 1960, p. 699-704.

The Effect of Oxide Microstructure on the Oxidation Kinetics of Cu-Ni-Mg Alloys. Small additions of Mg to a 62 Cu-38 Ni alloy reduce the oxidation rates drastically between 500 and 850 C. Metallographic examination of the oxide scale disclosed a continuous network, identified by X-ray diffraction as (Ni, Mg)O solid solutions, located along the former alloy grain boundaries. This network acts as a barrier to diffusion. It is thought to result from the segregation of Mg to the alloy grain boundaries. Oxidation occurs preferentially in these regions because of the presence of this more active element. To substantiate these ideas, homogenized alloys were oxidized. No oxide network was produced and oxidation rates were the same as for the parent 62 Cu-38 Ni alloy. ***J. A. Sartell, S. H. Bendel, and C. H. Li.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 809-812.

* **Corrosion of Welds in Stainless Steels of the 18-8 Type in Fuming Nitric Acid. Stabilized Steels and Low Carbon Steels.** Hot and cold tests revealed that low C steels have an excellent resistance to intergranular corrosion at the welds, whereas Ti steels exhibit a laminar corrosion along the welds. (*In French.*) Corrosion aux soudures des aciers inoxydables austénitiques du type 18-8 dans l'acide nitrique fumant. Aciers stabilisés et bas carbone. ***Michel L. J. Bernard and N. Flavian.*** *Corrosion et Anticorrosion*, v. 8, no. 10, Oct. 1960, p. 359-370.

Development of Corrosion-Resistant Alloys for Use as Container Materials for Decladding Solutions or as Welding Alloys. Twenty-four experimental alloys were developed and evaluated as container materials or welding alloys for use with Sulfex and Niflex decladding solutions. Niflex solutions, which were more corrosive than Sulfex solutions to most of the experimental alloys, produced severe localized attack at weldments made on vacuum-melted Hastelloy F with the experimental

alloys. However, several of the alloys, when self-welded, were not selectively attacked. Some of these showed a substantial improvement in resistance to the decladding solutions. The most promising alloys were based on either 45 w/o Ni-22 w/o Cr or 50 w/o Ni-25 w/o Cr, with at least 6 w/o Mo, and 1 w/o Ti, 0.6 w/o Mn, 0.4 w/o Si, 0.02 w/o C, and balance iron. The alloy most resistant to both solutions contained 6 w/o Mo and 1 w/o Cu in the 50 w/o Ni-25 w/o Cr base. ***Charles L. Peterson, David C. Drennen, Merritt E. Langston, A. M. Hall, and Walter K. Boyd.*** *U. S. Atomic Energy Commission, BMI*-1459, Aug. 8, 1960, 62 pp. (UF767 U3b Contin.)

The Mechanisms for Silicon Oxidation in Steam and Oxygen. Two of the fundamental infrared absorption bands show considerable isotopic shifts when films of SiO_2^{16} and SiO_2^{18} are compared. The SiO_2 films studied here, were prepared either by oxidizing Si in O at high temperatures or by oxidation in high pressure steam at a somewhat lower temperature. Measurements of films show that in both the steam and O cases considerable O isotopic exchange has taken place, which indicates that mobile O species diffuse into the film from the silica-gas interface. ***J. R. Ligenza and W. G. Spitzer.*** *Physics and Chemistry of Solids,* v. 14, July 1960, p. 131-136.

The Propagation of Corrosion Pits in Metals. Demonstrates experimentally, for the system Al/NaCl solution, both that the rate of corrosion per unit of active area is in fact a constant, and that changes in an external polarizing current, which alter the apparent rate of pitting, influence only the area on which the attack occurs and not the real rate of attack per unit of active area. ***C. Edeleanu.*** *Institute of Metals, Journal,* v. 89, pt. 3, Nov. 1960, p. 90-94.

METALS—EXTRACTION AND REFINING

Nuclear Purity Beryllium . . Its Manufacture. The valuable properties of Be in nuclear devices and reactors are nullified by high-neutron-absorption impurities. Describes techniques for refining Be to a purity suitable for nuclear applications. ***C. W. Schwenzfeier, Jr.*** *Journal of Metals,* v. 12, Oct. 1960, p. 793-797.

Aerodynamics of the Open-Hearth Furnace as a Means of Controlling the Processes of Combustion and Heat Exchange. Gives an account of Soviet research on the aerodynamics of an open-hearth furnace and their effect on combustion and heat-exchange processes. Extensive use has been made of models, and the results obtained provide a scientific basis for OH port design. ***M. A. Glinkor.*** *Iron and Steel Institute, Journal,* v. 196, pt. 1, Sept. 1960, p. 1-14.

* **Intensification of Open-Hearth Melting Through Desulfurization of Steel in the Ladle by Means of Mixtures.** Treating the metal in the ladle with a mixture consisting of 70 to 80% lime, 15 to 20% fluorite, and 5 to 10% ferrosilicon, with a consumption of 0.75 to 1.0% of the metal causes a 23 to 30% decrease of the S content with 0.16 to 0.28% Si in the ready steel. No effective elimination of S in the ladle is obtained in melts of boiling steel with 0.30 to 0.60% Mn. The material thus obtained has the same quality as usual melts. (*In Russian.*) Intensifikatsiia martenovskoĭ plavki posredstvom desul'furatsii stali v kovshe s pomoshch'iu smeseĭ. ***A. K. Omarov and A. E. Khlebnikov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia,* 1960, no. 8, p. 29-33.

* **Thermal Stresses in Ingot Molds.** Temperature changes at different points of wall sections and surfaces of the ingot mold from pouring of the ingot to its cooling were investigated. In the first min. after pouring ingot molds reach 600 to 700 C, after 30 min. only 200 C. This produces variable thermal stresses in the mold. (*In Czech.*) Tepelné namáhání ocelářských kokil. ***František Havlíček.*** *Hutnické Listy,* v. 15, no. 5, May 1960, p. 371-378.

* **Casting of Large Ingots for Sheet Metal Production From Aluminium Alloys.** Types of cracks found in flat ingots; stress distribution in ingots; influence of ingot shape and settling velocity on crack formation; protection against bottom cracks, and against top and lateral cracks. (*In German.*) Das Giessen von grossen Blöcken zur Erzeugung von Blechen aus Aluminiumlegierungen. ***W. A. Liwanow.*** *Neue Hütte,* v. 5, Sept. 1960, p. 535-542.

* **Use of Vapor for Intensification of Open-Hearth Furnaces.** The purity of steel of melts made with the use of vapor is high. It is shown that uneasiness concerning the raise of H content in steel was unjustified. The quality of steel for the production of sheets in regard to the ability of deep drawing, tendency to the formation of inclusions, and blisters of sheets is satisfactory. (*In Czech.*) Použití páry pro intensifikaci martinových peci. ***A. Bichler.*** *Hutnické Listy,* v. 15, no. 10, Oct. 1960, p. 778-781.

Pure Beryllium Via the Fluoride Process. Flowsheet of the process Be ore→beryllium hydroxide→Be metal is outlined. ***N. P. Chopey, editor.*** *Chemical Engineering,* v. 67, Oct. 31, 1960, p. 82-85.

The Carbon-Oxygen Equilibria in Liquid Iron. Equilibrium data on the reactions of gases with C and O dissolved in liquid Fe are reviewed and correlated. A source of error in O analysis of graphitic samples is exposed. New experimental data on the O content of high-carbon iron in equilibrium with CO indicate that the activity coefficient of O is decreased by additions of C. The C-O product decreases slightly with increasing C content. ***Tasuku Fuwa and John Chipman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 887-891.

* **Ore to Molten Metal by Direct Reduction.** Iron concentrate flows into one side of an induction furnace and molten Fe flows out the other. ***Albert De Sy.*** *Modern Castings,* v. 38, Nov. 1960, p. 38-41.

* **Treatment of Ball-Bearing Steel With Synthetic Slag.** When treating ball-bearing steel in a ladle by a synthetic calcarious-aluminous slag, the S content in the metal is sharply reduced. At the same time, contents of O and non-metallic inclusions in the produced steel are relatively low. The output of steel-melting electric furnaces is raised. (*In Russian.*) Obrabotka sinteticheskim shlakom sharikopodshipnikovoĭ stali. ***S. G. Voinov and A. G. Shalimov.*** *Stal'* v. 20, no. 10, Oct. 1960, p. 902-904.

* **Deoxidation of Iron by Vacuum Induction Melting.** An experimental study in a 100 lb. and a 300 lb. furnace shows that the minimum C and O concentrations are the result of a steady state between the deoxidation reaction and a secondary reoxidation by the refractory of the crucible. (*In French.*) Désoxydation du fer par fusion sous vide. ***Pierre Turillon.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 57e, no. 9, Sept. 1960, p. 649-658.

* **The Lining of Induction Vacuum Furnaces.** For lining these furnaces, it is best to use fused magnesite and fine-grained electric corundum. This material lasts from 60 to 200 heats when producing nickel-based alloys in the temperature range 1450-1530 C. ***A. V. Frolov and V. P. Grechin.*** *Stal' in English,* 1960, no. 6, June, p. 409-411.

* **Steel Production by the Duplex Process From Naturally Alloyed Pig Iron.** The successful Duplex process for melting steels from naturally alloyed Khalilovo pig irons, using a converter and basic open-hearth furnace, is characterized by careful slag control and a limited sulphur content of the ore. ***I. N. Varnavskii, N. P. Izotov, M. K. Musikhina, V. A. Aver'yanov, and O. P. Bolotov.*** *Stal' in English,* 1960, no. 6, June, p. 397-400.

* **Automatic Control of Blast-Furnace Stoves.** Automation of blast-furnace stove control at the Kuznetsk combine made it possible to raise blast temperature, greatly accelerate stove changing, improve stove efficiency, and free stovemen from a number of laborious tasks. ***E. A. Burlo and V. V. Burtsev.*** *Stal' in English,* 1960, no. 6, June, p. 393-396.

* **The Advantages of Using Cold Sinter in Blast-Furnace Smelting.** Operating experience at the Cherepovets works indicates the advisability of air cooling the sinter followed by screening to separate the 0-5 mm fines. This leads to an im-

provement in the aerodynamic properties of the charge, especially one with 100% sinter. ***S. I. Éliasberg.*** *Stal' in English*, 1960, no. 6, June, p. 388-390.

The Effect of Chromium on the Activity of Sulfur in Liquid Iron. The activity coefficient of S in Cr-Fe-S melts was determined by measuring the values of P_{H_2S}/P_{H_2} in equilibrium with such melts. The results showed that Cr has a pronounced negative effect on the activity coefficient of S, which up to about 20% Cr may be represented by the equation: $\log f_S^{Cr} =$ -0.019 pct Cr. It was also found that the influence of Cr was not altered by the presence of appreciable amounts of C or Si. ***N. R. Griffing and G. W. Healy.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 849-854.

* **Electrolytic Multicellular Furnaces for the Production of Aluminum With Self-Reconstituting Anodic Surfaces.** Mentions the main characteristics of multicellular furnaces, described in many recent Montecatini patents, which are considered the electrolytic cells of the future, because of their great capacity of production and because of their small specific power consumption, and describes the new means (Ferrand patents) which allow a completely automatic and continuous reconstitution. (*In French.*) Fours d'electrolyse multicellulaires pour la fabrication de l'aluminium à surfaces anodiques auto-reconstituantes. ***L. Ferrand.*** *Metallurgia Italiana*, v. 52, Aug. 1960, p. 520-530.

* **Experiments on the Production of Metallic Uranium by Reduction of Uranium Tetrafluoride With the Aid of Metallic Calcium.** A method of reduction of UF_4 and vacuum refining of crude U is reported. On the basis of the experimental results on apparatus for calciothermic reduction of UF_4 under reduced pressure, equipment was assembled. Reduction tests on a larger scale (with a charge of 11 kg UF_4) confirmed anticipated advantages of the method. (*In Polish.*) Prace doświadczalne nad otrzymywaniem uranu metalicznego przez redukcję czterofluorku uranu wapniem metalicznym. ***Mieczysław Perec, Franciszek Mucha, and Apoloniusz Dębiński.*** *Nukleonika*, v. 5, no. 9, 1960, p. 559-568.

Low Pressure Metallurgy. Vacuum as an Inert Atmosphere. Discusses such aspects as the gas tightness of a vacuum system; contamination during vacuum melting of such metals as Fe, Ni, and U; and vacuum oxidation processes in the solid state. (To be continued.) ***A. S. Darling.*** *Metallurgia*, v. 62, Oct. 1960, p. 139-142.

* **The Influence of the Oxidation Condition of Iron in an Agglomerate on Its Treatment in the Blast Furnace.** On the basis of results from four months' operation of a blast furnace in which a charge made up of 60% crude ore and 40% agglomerate (70% fine Lorraine ore and 30% flue dust) was smelted, the author establishes a relationship between the weight of the burden per day and the degree of oxidation of the agglomerate: the weight of the burden is increased by 200-400 kg when the degree of oxidation rises by one point (for instance, from 80 to 81%). (*In French.*) Influence de l'état d'oxydation du fer d'un aggloméré sur son traitement dans le haut fourneau. ***F. Pesche.*** *Revue de Métallurgie*, v. 57, Sept. 1960, p. 771-773.

Purification Factor Characterization of Zone Refining. A quantity π_T, termed the purification factor, defines the potential state of purity realizable in a specimen that has undergone zone-refinement treatment. An exact analysis appears intractable, but neglect of the terminal zone perturbation allows a lower bound to be established on the solute impurity. ***Louis Gold and Virginia Johnson.*** *Franklin Institute, Journal*, v. 270, no. 5, Nov. 1960, p. 367-381.

Apparatus for the Floating-Zone Refining of Gallium Arsenide. The design and operation of equipment to purify and to grow single crystals of gallium arsenide are described. Features of the design include a demountable quartz system, adjustment of the relative position of the ends of the gallium arsenide rod during operation, excellent visibility, a traversable heater system, and close control of the arsenic pressure in the tube. ***F. A. Cunnell and R. Wickham.*** *Journal of Scientific Instruments*, v. 37, Nov. 1960, p. 410-414.

METALS—FINISHING, POLISHING AND CLEANING

* **Use of Radioactive Isotopes for the Selection of a Lubricant-Coolant for Polishing.** Application of radioactive isotopes showed details of the polishing process. The method permits observation of the adherence of the metal to the operating surface of the polishing wheel. (*In Russian.*) Primenenie radioaktivnykh izotopov dlia vybora smazyvaiushcheokhlazhdainshcheĭ zhidkosti pri shlifovanii. ***S. N. Korchak.*** *Stanki i Instrument*, v. 31, no. 10, Oct. 1960, p. 26-28.

* **Surface Treatment Extends Metal Life.** Finishing is emphasized. ***B. M. Pearson.*** *Machinery Lloyd (Overseas Ed.)*, v. 32, no. 21, Oct. 8, 1960, p. 41-43.

* **Modern Polishing and Buffing.** Materials and methods. ***Stanley P. Sax.*** *Metal Finishing*, v. 58, Oct. 1960, p. 51-55.

* **Cleaning Fine Wire Drawing Dies.** Ultrasonic cleaning methods are applied. ***John W. Cowan.*** *Ultrasonic News*, v. 4, no. 3, Fall 1960, p. 10-15.

* **Chemical Polishing of Aluminium and Its Alloys.** ***Charles C. Cohn.*** *Electroplating and Metal Finishing*, v. 13, Nov. 1960, p. 421-423.

METALS—FOUNDRY PRACTICE

Shrinkage Defects in Iron Castings. A study of the influence of various factors such as mold-type, composition, pouring temperatures, etc., on the severity and type of shrinkage defects in iron castings. Compares the effects of nine such variables during simulated commercial production. (To be continued.) ***J. H. Gittus.*** *Iron & Steel*, v. 33, no. 11, Oct. 1960, p. 494-498.

* **New Method of Mold Assembling.** Several methods of the assembly of molds and cores for castings of machine-tools and tractors are described. Principal advantages of this method are, the velocity of assembly of molds, the possibility to employ shortly trained workers, the greater dimensional accuracy of castings, and in the smaller danger of waste castings caused by sand inclusions and warpage of castings. (*In Czech.*) Souborné skládáni forem. ***Vlastislav Otáhal and Julius Kolařik.*** *Slévárenství*, v. 8, no. 9, Sept. 1960, p. 308-313.

* **Aluminum Alloy Test Bar Casting Temperature Effect on Properties.** After a recapitulation of the role of separately cast test bars in checking the melt quality and the response to heat treatment, a general review is presented on the effects of pouring temperature, maximum melt temperature and prolonged holding time on the properties of aluminum sand casting alloys. Separately cast test bars can be used successfully for melt quality evaluation only if they are cast under standardized and strictly controlled conditions. To accomplish this, they should be cast at the most suitable temperatures, independent of the pouring temperature of the production castings. The aim of this investigation was to evaluate the effect of various pouring temperatures on the mechanical properties, the grain size and the porosity (density) of separately cast test bars in six commonly used commercial alloys. Consideration was also given to the effects of overheating of the melt and of prolonged holding times at three temperature levels. ***J. W. Meier and A. Couture.*** *Modern Castings*, v. 38, Nov. 1960, p. 98-109.

Characteristics of Foundry Sands. The availability, cost, stability, density, melting point, and other characteristics of silica, zircon, olivine, carbon, chamotte, and mullite sands are discussed. ***W. P. Winter.*** *Foundry*, v. 88, Dec. 1960, p. 79-81.

Shrinkage Defects in Iron Castings. Describes the results of experiments to determine the influence of temperature, inoculation, and metal composition on the incidence of sinks,

draws, tears, and internal porosity in test castings of gray iron. ***J. H. Gittus.*** *Iron & Steel*, v. 33, no. 12, Nov. 1960, p. 552-555.

* **Molten Metal Handling in Die Casting Plants.** The various ways metal is transferred in die casting plants are discussed. Special emphasis is placed on the use of centrifugal pumps for this purpose. The discussion includes the various types of ladles used and how they are mounted. Siphoning and gravity feed by launder are described. Pump construction and use are discussed. ***Victor D. Sweeney.*** *Modern Castings*, v. 38, Nov. 1960, p. 110-116.

* **Contribution to the Increase of the Shaft Furnaces Yield.** The influence of grain size and distribution, charge height, shaft and boshes angle, shaft construction, tuyeres diameter and gas streaming in the charge on the organization of gas streaming distribution in the working space of the shaft furnace is dealt with. (*In Czech.*) Příspěvek ke zvyšování výkonů šachtových pecí. ***Svatopluk Černoch.*** *Hutnické Listy*, v. 15, no. 5, May 1960, p. 382-389.

Aluminum Diecasting Can Be Welded Brazed or Anodized. The combination of a new alloy and vacuum diecasting has made possible production of Al diecastings which can be anodized, porcelain enameled, chrome plated, welded, or dip brazed. ***Jack C. Miske.*** *Foundry*, v. 88, Nov. 1960, p. 114-115.

* **Solidification Conditions for Maximum Density and Mechanical Properties in 85-5-5-5 Castings.** A major factor affecting the mechanical properties and pressure tightness of bronze castings is their soundness. The data of this investigation indicate that for both plate and bar sections poured under a wide variety of chilling and risering conditions the chief factor determining the soundness of a section is the thermal gradient during solidification. Although the liquidus-solidus interval for 85-5-5-5 is about 220 F, a gradient of 60 F/.in provides sufficient liquid flow to feed shrinkage during solidification. It is suggested that the specimen which has been developed and which provides a wide range of known thermal gradients can be applied to rate other alloys as a castability bar. In this way the thermal gradient needed to produce sound sections of a given alloy may be determined from a single test and the mold design can be approached with confidence. ***R. A. Flinn and H. Kunsmann.*** *Modern Castings*, v. 38, Nov. 1960, p. 55-64.

* **Physical and Chemical Conditions Variation Effect on Bentonite Suspension Properties.** Effect of Bingham yield value of bentonite suspensions produced by the addition of reagents, some of which resemble those which could occur under natural conditions. The effect of these reagents on the pH of bentonite suspensions was examined. By means of differential thermal analysis it was shown that phosphate ions are adsorbed into interlayer and lattice positions. It was also shown that tannates and similar reagents are not adsorbed. ***A. J. Anderson and G. J. Sutton.*** *Modern Castings*, v. 38, Nov. 1960, p. 88-97.

* **Porosity in Unalloyed Steel Castings.** The behavior of unalloyed C steels in bentonite sands and in shells when using a special model for all tests was examined. The H absorption does not depend on the water content of the sand. Increase in the casting temperature causes increased H absorption. Porosity depends on the final H content and also on the Si or Si and Al content. Edge bubbles are caused by high casting temperatures and a high initial H concentration. (*In German.*) Porosität in unlegiertem Stahlguss. ***Otto Heide.*** *Giesserei, Technisch-Wissenschaftliche Beihefte*, no. 30, Oct. 1960, p. 1655-1668.

Effect of Ferrous Oxide on Zircon Sand at 1200°C. At 1200 C, there are three compatibility triangles in the system FeO-ZrO_2-SiO_2; fayalite, tridymite, zircon; fayalite, zircon, zirconia; fayalite, zirconia, wüstite. The FeO-ZrO_2 and Fe_2SiO_4-ZrO_2 joins are binary systems. The former has a eutectic near 1320 C and the latter has a eutectic near 1180 C. Fe_2SiO_4-$ZrSiO_4$ is not a binary system at all temperatures, for zircon dissociates into zirconia and silica above 1500 C. At 1200 C, a region of liquid is found surrounding the fayalite composition and extending into each of the three compatibility regions. Ferrous oxide at 1200 C causes a dissociation of zircon sand and the formation of an iron-rich silicate liquid. ***Ralph G. Wells, Lawrence H. Van Vlack, and Ronald Lalonde.*** *American Ceramic Society Bulletin*, v. 39, Dec. 1960, p. 735-739.

METALS—HEAT TREATMENT

a

Fluidized Bed: New Approach to Rapid Heat Treating. General Electric Industrial Heating Division presents a heat-treat furnace with fluid bed; increased efficiency and product quality are claimed. ***C. L. Kobrin.*** *Iron Age*, v. 186, no. 15, Oct. 13, 1960, p. 81-83.

b

Annealing Commercially Pure Titanium. Investigation of the annealing characteristics of two grades of commercially pure Ti has shown that for many purposes it would be satisfactory to use an annealing treatment which theoretically appears suitable for material with 25-50% deformation. As a result of this work, a relationship has been established between hardness and annealed grain size. ***M. A. H. Howes.*** *Metallurgia*, v. 62, Sept. 1960, p. 95-100.

c

Twin Chamber Electric Batch Furnaces for Heat Treating Aluminium Wire. *Metallurgia*, v. 62, Sept. 1960, p. 115-116.

Induction Hardening of Cast Iron Cylinder Liners. Surface hardening of cast iron cylinder liners using radio frequency induction heating is described, and the advantages over normal through-hardening methods are pointed out. *Iron & Steel*, v. 33, no .11, Oct. 1960, p. 512-513.

d

Annealing Equipment for the Malleable Iron Foundry. Elevator, bell, roller hearth, and pusher furnaces are discussed. Processing of pearlitic malleable iron and economics of malleablizing are considered. ***B. A. Ruediger.*** *Foundry*, v. 88, Dec. 1960, p. 85-89.

e

* **Effect of Carbide Stringers on the Distortion of Die Steels During Heat Treatment.** The causes and mechanism of distortion of die steels during heat treatment, the influence of the structure of the steel, and in particular, the part played by carbide stringers, are studied. ***K. Sachs.*** *Metal Treatment and Drop Forging*, v. 27, Oct. 1960, p. 395-400.

f

Temperatures for Rapid Uniaxial Stress Relief of Heat-Resistant Alloys. A hot-test technique is advanced for selecting the temperatures needed to reduce stresses below a selected level. ***Howard S. Avery.*** *Welding Journal (Suppl.)*, v. 39, Nov. 1960, p. 509s-512s.

g

METALS—MECHANICAL AND PHYSICAL PROPERTIES

h

Effects of Non-Uniformities on the Hardening of Crystals. The ease of motion of a dislocation in a crystal is influenced by changes in lattice parameter and elastic modulus. For solid solutions where such changes are gradual, the hardening is negligible, but for abrupt changes, such as occur at a precipitate, the effect is important. The changes in lattice parameter lead to the production of interface dislocations and suggest a work-hardening model for one class of precipitation-hardened alloys. Interface dislocations may also affect flow near a free surface. ***R. L. Fleischer.*** *Acta Metallurgica*, v. 8, Sept. 1960, p. 598-604.

i

Criteria for Yielding of Dispersion-Strengthened Alloys. A dislocation model is presented to account for the yield behavior of alloys with a finely dispersed second phase. The criteria for yielding, used in the model, is that appreciable yielding occurs in these alloys when the shear stress due to piled-up groups of dislocations is sufficient to fracture, or plastically deform the dispersed second-phase particles, relieving the back stress on the dislocation sources. Equations derived on the basis of this model, predict that the yield stress of the alloys varies as the reciprocal square root of the mean free path between dispersed particles. Experimental data is presented for several SAP-Type alloys, precipitation-hardened alloys and steels which are in good agreement with the yield strength variation as a function of dispersion spacing predicted by this theoretical treatment. ***G. S. Ansell and F. V. Lenel.*** *Acta Metallurgica*, v. 8, Sept. 1960, p. 612-616.

j

k

The Behavior of Composite Silver-Alumina Alloys Above the Melting Point of Silver. Composite alloys are shown to resist flow above the melting point of the continuous matrix. The ability to resist flow depends on the fineness of the dispersion and the O content of the Ag. It is believed that the O influences very strongly the bond between the molten Ag and the finely divided alumina. ***H. R. Peiffer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 775-777.

High-Temperature Slip in Tungsten. Single crystals of W were made and deformed in tension at 3000 C. The slip traces so formed on these crystals were analyzed to determine the apparent slip system. Results indicate that deformation occurs in the <111> direction on planes of maximum shear stress. This determination agrees with the early work of Taylor and Elam on other body-centered cubic crystals at low temperatures. ***Sam Leber and J. W. Pugh.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 791-793.

The Deformation of Unalloyed Titanium Sheet as Function of Orientation and Strain Rate. The modulus of elasticity and yield strength of commercially pure, annealed Ti sheet was investigated at room temperature as a function of strain rate and direction of loading. The value of E varied with direction of measurement in the sheet but was unaffected by strain rate in the range 0.04 x 10^{-3} to 10^{-2} min^{-1}. The yield strength increased with increase in strain rate and varied with specimen orientation. ***C. P. Gazzara and E. P. Klier.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 796-798.

Deformation Modes of Zirconium at 77°, 575°, and 1075°K. The only slip system observed was $(10\bar{1}0)$ $[1\bar{2}10]$ with a critical resolved shear stress in tension of 1.0 kg per sq mm at 77 K; 0.2 kg per sq mm at 575 K; and 0.02 kg per sq mm at 1075 K. The active twin planes were $\{10\bar{1}2\}$, $\{11\bar{2}1\}$, $\{11\bar{2}2\}$, and $\{11\bar{2}3\}$ with varying temperature dependence. A detailed analysis for the slip direction using Laue spot asterism is appended. ***E. J. Rapperport and C. S. Hartley.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 869-877.

Dispersion-Hardening in Binary Titanium-Copper Alloys. Dispersion-containing titanium-copper alloys were prepared having mean free paths varying from 1.0 to 9.7 μ. Tensile studies at room temperature and at 1000 F showed that little or no strengthening occurred when the mean free path exceeded 3μ. However, at lower values of mean free path appreciable strengthening was observed. A considerable amount of strengthening also resulted from Cu in solid solution. ***D. N. Williams, R. A. Wood, H. R. Ogden, and R. I. Jaffee.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 787-791.

The Effect of Hydrogen on the Mechanical Behavior of Aged Alpha-Beta Titanium Alloys. Specimens of Ti-155A (Ti-5Al-1.3Fe-1.3Cr-1.2Mo), Ti-6Al-4V, and Ti-4Al-3Mo-1V were hydrogenated, aged to high strength levels, and subjected to notched stress-rupture tests and tensile tests at two strain rates. Both Ti-6Al-4V and Ti-155A were relatively unaffected by hydrogen in amounts exceeding those found in commercially produced material. Inconsistencies in the data and a relatively low initial level of ductility prevented an accurate determination of the hydrogen tolerance for aged Ti-4Al-3Mo-1V, but there was no evidence that this alloy was any more susceptible to hydrogen embrittlement than Ti-155A and Ti-6Al-4V. ***R. A. Nadler and D. L. Day.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 841-844.

Characteristics of Cold-Rolled and Annealed Titanium. Electrorefined, Mg-reduced, and Na-reduced Ti samples were evaluated for recrystallization behavior, effect of cold rolling on tensile properties, and bend ductility. The presence of metallic impurities greatly inhibits coarsening for reductions in thickness below 20%, but for reductions in excess of 20% grain size is essentially constant at each annealing temperature. The three grades of Ti did not harden excessively from cold rolling; both

tensile and bend ductility were good for reduction in thickness up to 80%. ***Jack D. Ramsdell and Ernest D. Hull.*** *U. S. Bureau of Mines Report of Investigations* 5656, 1960, 15 pp. (TN21 Un3r Vis.)

Factors Related to the Tensile Strength of Cast Iron. Considers the relationship between tensile strength, chemical composition, and section size, together with other factors which affect the tensile strength of cast iron. In particular, the effect of eutectic cell size on tensile properties and the mechanism whereby cell size affects tensile strength are discussed. ***G. N. J. Gilbert.*** *B.C.I.R.A. Journal,* v. 8, no. 5, Sept. 1960, p. 695-702.

The Influence of Trace Elements on Embrittlement Phenomena in Low-Alloy Steels. Work using high-purity materials has made it possible to distinguish between the influence of major alloying elements and of trace elements in causing "350 C embrittlement" and temper-brittleness in Ni-Cr and Ni-Cr-Mo steels. These three elements are not primarily responsible, but the presence of certain minor impurity elements is essential. ***J. M. Capus and G. Mayer.*** *Metallurgia,* v. 62, Oct. 1960, p. 133-138.

* **Characteristics of High-Strength Zinc-Base Alloys Containing Manganese and Copper.** The results of a precise tensile test performed by the method of resistance tensometers determine the elastic limit as 39% and the yield strength as 68% of the ultimate tensile strength. The longitudinal elastic modulus exceeds 10,000 kG/m^2 and Poisson's ratio is 0.25. The impact values for as-cast notched test pieces are about 1 kGm/cm^2. (*In Polish.*) Charakterystyka wysokowytrzymałościowych stopów cynku z manganem i miedzią. ***Władysław Kajoch.*** *Archiwum Hutnictwa,* v. 5, no. 3, 1960, p. 291-319 + 1 plate.

Short Cut to High-Temperature Strength Prediction. A rate process parameter boils down complex temperature-time exposures of metals to a simple curve for each mechanical property. ***D. M. Badger and C. D. Brownfield.*** *SAE Journal,* v. 68, Nov. 1960, p. 68-74.

Effects of Internal Oxidation and Heat Treatment on the Electrical Resistivity of Dilute CuMn, CuFe, and CuCo Alloys. The solutes in the CuFe and CuCo wires and rods become rapidly oxidized (internally) during heat treatment for several hours at 990 C in pure O pressures of 0.5 μ or greater, while in 0.05 μ O this oxidation is absent and previously oxidized specimens are reduced. These observations are based on measurements of electrical resistivity, and in the case of CuFe, substantiated by measurements on the magnetization. Wires and rods of CuMn rapidly become nonuniform in solute concentration throughout their cross section when annealed near 1000 C for several hours either in a vacuum (0.1 μ air) or in 5 μ of pure O. ***C. A. Domenicali and E. L. Christenson.*** *Journal of Applied Physics,* v. 31, Oct. 1960, p. 1730-1733.

* **Creep Behavior and Stress Relaxation of Cold-Formed Steel Wires With Differential Preliminary Treatments.** A study covering the changes of tensile strength and elongation of steel wires with equal final strength, but very different cold deformation during reheating between 100 and 450 C, and of the creep and stress relaxation of such wires with and without a tempering treatment at room temperature and at relatively high temperatures, measure of elastic recovery. (*In German.*) Kriechen und Spannungsrelaxation kalt verformter Stahldrähte mit unterschiedlicher Vorbehandlung. ***August Pfützenreuter.*** *Stahl und Eisen,* v. 80, no. 20, Sept. 29, 1960, p. 1321-1336.

The Thermoelectric Power of Pure Copper. Measurements of the absolute thermoelectric power S of very pure Cu samples (with residual resistivity ratios as low as 3.1 x 10^{-4}) were carried out between ~0.1 K and ~350 K. Several specimens were found to exhibit marked negative anomalies in S between 8 K and 9 K, whereas a very pure sample of "natural" Cu gave small but positive values of S at low temperatures. By emphasizing that S depends on the relative importance of the various scattering mechanisms it was shown that the anomalies occur whenever scattering by traces of Fe becomes dominant, other impurities being of only minor importance. ***A. V. Gold, D. K. C. MacDonald, W. B. Pearson, and I. M. Templeton.*** *Philosophical Magazine,* v. 5, ser. 8, Aug. 1960, p. 765-786.

* **The Effects of Manganese on the Qualities of a Deep-Drawn Steel Sheet.** Six steel sheets with a low Mn content were subjected to deep drawing. Pressing and sinking tests

showed that the properties of this steel for cold forming are satisfactory. The internal cohesion during pressing is good and these products are as suitable for practical purposes as those with a normal Mn content. (*In Czech.*) Vliv manganu na hlubokotäznost ocelového plechu. ***Bohuslav Otta Josef Teindl.*** *Hutník (Czech)*, v. 10, no. 9, Sept. 1960, p. 351-354.

The Effect of Ageing on Young's Modulus, Electrical Resistivity, and Hardness of 80:20 Manganese-Copper Alloy. ***H. J. Stokes and I. D. Hewin.*** *Institute of Metals, Journal*, v. 89, pt. 2, Oct. 1960, p. 77-79.

The Development of Strain Markings in Copper and Alpha-Brass. Some Effects of Deformation Temperature. The incidence of strain markings is shown to vary markedly with deformation temperature. The nature of the markings is also affected, and there is a regular relationship between Zn content, deformation temperature, and microstructure. In some respects, this relationship is consistent with the development of stacking faults in the alloys, but it may also be interpreted as providing evidence for the existence of mechanical twinning as a deformation mechanism in face-centered cubic metals. The results indicate that previous experiments do not necessarily preclude this possibility. ***M. Hatherly.*** *Institute of Metals, Journal*, v. 89, pt. 2, Oct. 1960, p. 60-64.

Initial Stages of Plastic Deformation in Copper and Aluminum. The early stages of plastic flow and microcreep were studied in single crystals and in polycrystalline Cu and Al, using a method with a strain sensitivity of 2×10^{-6} in the temperature range −196 to 25 C. The temperature dependence of the 10^{-6} yield stress is interpreted as arising from a thermal activation of stacking faults under stress. This model results in a value of 25 ergs/cm² for the stacking fault energy of Cu and 100 ergs/cm² for Al. ***A. R. Rosenfield and B. L. Averbach.*** *Acta Metallurgica*, v. 8, Sept. 1960, p. 624-629.

Study of Fatigue Properties of Ultra-High Strength Steel. A temper-resistant, high-strength steel was investigated with reference to fatigue strength. This alloy was prepared by two different melting techniques. The first method consisted of induction melting in air, using standard deoxidation techniques. The second method involved the application of a special deoxidation practice to induction melting; silicon-free steel was deoxidized with C and Al to minimize the presence of silicate inclusions. These alloys were tested in fatigue, using the Prot accelerated method. The results of the samples melted with standard practice indicated that fatigue strength is improved slightly by tempering at elevated temperature. The application of a special melting process showed that a very significant increase in the Prot fracture stress to ultimate tensile strength ratio (E_p/UTS) can be obtained by eliminating the presence of Si and deoxidizing with C and Al. ***Harvey B. Nudelman and John P. Sheehan.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 60-120, June 1960, 57 pp. (TL507 Un3.18w Vis.)

Effect of Hydrogen on Stability of Micro Cracks in Iron and Steel. A Stroh crack ceases to be stable when a critical internal pressure is reached in the absence of an external stress. It is shown that in Fe and steel, the amount of H needed to reach the critical pressure is within the range found experimentally for extensive internal cracking. The stability of a microcrack is also considered for the condition of an imposed external stress and internal pressure. It is predicted, as observed experimentally by others, that pronounced H embrittlement of Fe or steel may be caused by as little as 2 cm³ of H per 100 g of metal (approximately 2 p.p.m.). ***F. Garofalo, Y. T. Chou, and V. Ambegaokar.*** *Acta Metallurgica*, v. 8, Aug. 1960, p. 504-512.

* **Effect of Temperature and Deformation Rate on Carbon Steels.** Any increase in the deformation rate between 20 and 1200 C results in a rise in the yield point and to lesser extent in the true tensile strength; the sensitiveness of the yield point to a change in deformation speed at the same temperature increases with a decrease in the C content of the steel. ***V. S. Zoteev.*** *Stal' in English*, 1960, no. 6, June, p. 440-442.

The Plastic Deformation of Alpha-Uranium. Describes the results of uniaxial creep tests under isothermal conditions and presents a relation between secondary creep rate, stress and

temperature which applies between 450 and 650 C. Also describes the effects of thermal cycles on the plastic deformation under load. Experimental results are given and a theory developed to relate the plastic deformation to the applied stress and the amplitude of the cycle. ***A. G. Young, K. M. Gardiner, and W. B. Rotsey.*** *Journal of Nuclear Materials*, v. 2, no. 3, Sept. 1960, p. 234-247.

The Effect of Neutron Irradiation on the Tensile Properties of Zircaloy-2. ***L. M. Howe and W. R. Thomas.*** *Journal of Nuclear Materials*, v. 2, no. 3, Sept. 1960, p. 248-260.

Stress-Rupture Testing of Aluminium-1% Nickel-0.5% Iron Alloy. Stress-rupture tests were performed at 150-350 C. The strength properties at these temperatures are rather poor. At 250 C the stress-rupture properties seem to be sensitive to the size and distribution of the particles of the intermetallic *T* phase. ***V. de L. Davies.*** *Institute of Metals, Journal*, v. 89, pt. 1, Sept. 1960, p. 22-23.

Creep and Hardness of Metals: A Physical Study. In a study of the effect of time of loading on the indentation hardness of metals, measurements were carried out on In and Pb from liquid-air temperature to 50 C below the melting point. A spherical indenter was used and loading times were varied from 10^{-4} to 10^{3} sec. Apart from some preliminary experiments, the study was confined to single crystals. In general, the hardness or yield pressure p decreases with loading time t. Above $\sim 0.6\ T_m$, where T_m is the melting temperature (°K), and for times of loading exceeding a few seconds, a linear relationship exists between log p and log t. In this temperature range, experiments carried out at various temperatures give a series of parallel lines, the separation between them providing a measure of the activation energy involved. The values obtained are 16 kcal/mole for In and 28 kcal/mole for Pb, which are close to the activation energies for self-diffusion. Metallurgical examination shows that there is negligible recrystallization or other grain-boundary effects during the course of one experiment. The deformations around the indentation correspond to slip, suggesting that the rate-limiting process to creep in this temperature range is dislocation climb. If the loading time is reduced below ~1 sec, there is a marked rise in hardness, and for values of t less than $\sim 10^{-2}$ sec an upper limit to p is reached (p_{max}) which is the same whatever the initial temperature of the experiment. In the case of In the deformation also changes from slip to twinning. If hardness measurements are made at liquid-air temperature, the hardness is almost independent of loading time and is roughly equal to p_{max}. With In the deformation at these low temperatures occurs by twinning, whatever the loading time. It is apparent that for temperatures $> 0.6\ T_m$ the creep process is dominated by a self-diffusion mechanism. If the loading time is too short or if the temperature is very low, this mechanism cannot operate and the hardness is greatly increased. ***T. O. Mulhearn and D. Tabor.*** *Institute of Metals, Journal*, v. 89, pt. 1, Sept. 1960, p. 7-12.

The Effect of Cold Work on the Fatigue Properties of Two Steels. Fatigue tests were carried out on blanks of typical mild and nickel-chromium steels after subjecting them to varying amounts of cold work, in order to determine the maximum possible increase in fatigue strength resulting solely from cold work. An appreciable increase in fatigue limit can be achieved by cold working mild steel, there being an optimum value for the amount of prior strain. There is some indication that the fatigue limit of a 2½% nickel-chromium alloy steel may be slightly increased by cold work. ***N. E. Frost.*** *Metallurgia*, v. 62, Sept. 1960, p. 85-90.

The Creep and High-Temperature Fatigue Properties of the Magnesium-Base Canning Alloy, Magnox A.12. A study was made of this alloy, currently used as the canning material in the Calder Hall and Chapelcross reactors. Particular attention was paid to creep behavior in the lower range of reactor temperatures, where this alloy exhibits its minimum ductility and where intergranular cavitation is most prevalent. The effects of temperature, strain rate, and grain size on both ductility and cavitation were investigated. In view of the lack of data on the high-temperature fatigue strength of this alloy, a preliminary survey was made over the range 225-500 C. Detailed studies were carried out at 400 and 450 C, where the fatigue strength attained its lowest value. With the exception of very short-term tests in which general cracking occurred, fatigue failure was

attributable to the development of intergranular cavities and their subsequent interlinking. The effect of initial grain size and grain growth during test was studied at 400-500 C. It is shown that grain coarsening gives rise to increased fatigue strength at these temperatures. ***P. E. Brookes, N. Kirby, and W. T. Burke.*** *Institute of Metals, Journal*, v. 88, pt. 12, Aug. 1960, p. 500-508.

The Saturation Magnetostriction Constants of Nickel Within the Temperature Range -196° to 365° C. ***R. R. Birss and E. W. Lee.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 502-506.

* **Properties of Plain Carbon and Alloyed Structural Steels Made by the "LD" Process.** Comparison of the values obtained in the tensile test and in the Erichsen cupping test of cold-rolled strip made of "LD"-, open-hearth, and improved converter steel. Behavior in hardening and content of nonmetallic inclusions of plain C and alloyed "LD" steels having a higher content of C compared with that of corresponding open-hearth or electric furnace steels. Content of unintentional accompanying elements in "LD" steels. (*In German.*) Eigenschaften der nach dem "LD"-Verfahren hergestellten unlegierten und legierten Baustähle. ***Sepp Ammareller and Walter Knorr.*** *Stahl und Eisen*, v. 80, no. 21, Oct. 13, 1960, p. 1417-1423.

* **Study of Mechanical and Magnetic Characteristics of Ferromagnetic Materials by Ultrasonic Techniques.** Effects of elastic tensile and compressive stresses on ultrasonic attenuation of annealed and cold-worked Armco iron and SAE 1020, SAE 4340, and AISI 420 stainless steels. ***W. J. Bratina and D. Mills.*** *Canadian Mining and Metallurgical Bulletin*, v. 53, no. 582, Oct. 1960, p. 788-791; *Canadian Institute of Mining and Metallurgy Transactions*, v. 63, 1960, p. 538-541.

The Fatigue Curves of Copper. The fatigue tests were conducted on a rotating cantilever machine and the specimens were of electrolytic tough-pitch Cu, annealed for 1 hr. at 500 C in vacuum before testing. The S/N curve, determined from a substantial number of tests, showed a hitherto unsuspected discontinuity at a stress amplitude of ~ 21,500 lb/in^2. It was confirmed by metallographic observation that this discontinuity corresponded to a change in the mode of fatigue failure. ***J. Porter and J. C. Levy.*** *Institute of Metals, Journal*, v. 89, pt. 3, Nov. 1960, p. 86-89.

Some Elastic and Thermal Properties of Zirconium and Tungsten. The longitudinal and shear wave velocities of 10 Mc/s ultrasonic waves have been measured in polycrystalline specimens of Zr and W at temperatures between 14 and 300 K and the elastic constants calculated from these measurements. Gamma values for Zr and W estimated by this method are greater by factors of about 1.3 and 2.8 respectively than the values obtained from low-temperature calorimetric determinations. ***A. Myers.*** *Philosophical Magazine*, v. 5, ser. 8, Sept. 1960, p. 927-938.

Some Properties of Chromium and Chromium-Tungsten Alloys. I. Compression Creep Tests. II. Fabrication and Ductility. The solution-hardening effect of relatively small W additions causes a very marked reduction in the creep rate. Arc-melted ingots (1½ in. in dia.) of Cr-W alloys containing up to 10% W have been fabricated to strip by extrusion and rolling. For "cold-worked" materials, the addition of W first lowered and then raised the ductile/brittle transition temperature in slow bending, so that alloys containing up to 5% W were ductile at room temperature under these conditions. The evidence suggests that, in the alloys, W atoms progressively replace N atoms in the Cottrell atmospheres around dislocations. I. ***C. S. Landau, H. T. Greenaway, and A. R. Edwards.*** II. ***S. T. M. Johnstone, F. Henderson, and H. L. Wain.*** *Institute of Metals, Journal*, v. 89, pt. 3, Nov. 1960, p. 97-104.

* **Effects of Elastic Vibrations on the Internal Friction at Low Temperatures in an Aluminum Alloy With 2% Magnesium.** The height of the friction peak near 250 K increases with the increase in the number of vibrations of the specimen. This peak is connected with the motion under the effect of the stresses of the defects in the crystal lattice of the vacancy group type appearing during the vibrations. (*In Russian.*) Vliianie uprugikh kolebaniĭ na vnutrennee trenie pri nizkikh temperaturakh v

splave aliuminiia s 2% magniia. ***V. P. Ketova and V. A. Pavlov.*** *Fizika Metallov i Metallovedenie*, v. 10, no. 3, Sept. 1960, p. 445-452.

Theory of Impurity Resistance in Metals. A many-body technique is developed for the calculation of the dc resistivity of a Fermi fluid in the presence of a few randomly scattered fixed impurities. A certain class of graphs yields an expression for the conductivity which is similar in form to the standard classical transport coefficient; but the decay time is determined by the scattering of single particle-like excitations at the Fermi surface by screened impurities. ***J. S. Langer.*** *Physical Review*, v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 714-725.

Paramagnetic Behavior of Polycrystalline Samarium From 300°K to 1400°K. ***Sigurds Arajs.*** *Physical Review*, v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 756-759.

Electrical Resistivity of the Heavy Rare-Earth Metals. The electrical resistivities of polycrystalline Gd, Tb, Dy, Ho, Er, Tm, and Lu have been measured between 1.3 K and room temperature. The slope of the resistivity curve for Gd changes near the Curie point. The curve for Tb is very much like that for Gd, but there is some evidence that two ordering temperatures exist for this metal. Dysprosium, Ho, and Tm all show peaks in resistivity near their Néel points, while Er shows only a change in slope at its Néel point. The change from ferromagnetism to antiferromagnetism in Dy is seen as a sharp rise in the resistivity. ***R. V. Colvin, Sam Legvold, and F. H. Spedding.*** *Physical Review*, v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 741-745.

Comparison and Analysis of Notch-Toughness Tests for Welded Steel. Interpretive survey of the notch-toughness literature attempts to clarify the degree of correlation among the results of different tests that have been devised. ***H. H. Johnson and R. D. Stout.*** *Welding Journal* (Suppl.), v. 39, Nov. 1960, p. 493s-501s.

* **Problems Involved in the Development of Programmed Fatigue Testing.** Results show that the load sequence pattern has an important effect on Miner's $\Sigma(n/N)$ ratio, but contradictory results are obtained in tests on aluminum alloys and mild steel. Comparison of the relationship between random fatigue loading and the program loading pattern recommended by Gassner shows that for aluminum alloys, the program test is a conservative estimation of the fatigue life in variable loading. Tests on aluminum alloys reveal a discontinuity in the S/N curve. ***T. R. G. Williams and D. H. Hughes.*** *Engineer*, v. 210, Oct. 28, 1960, p. 703-705.

A Reversed-Bend Test to Study Ductile to Brittle Transition. The use of a sharply bent beam as a test specimen to explore the influence of material and environment on the borderline between ductile and brittle behavior of structural steels is proposed. ***J. H. Ludley and D. C. Drucker.*** *Welding Journal*, v. 39, Dec. 1960, p. 543s-546s.

METALS—MECHANICAL WORKING

* **Technical Developments in Modern Drop Stamps and Forging Presses.** Considers basic factors which govern the design of drop hammers and forging presses. (To be continued.) ***J. S. Byam-Grounds.*** *Metal Treatment and Drop Forging*, v. 27, Oct. 1960, p. 415-421.

Steel Bloom Piping. Test Results During Continuous X-Ray Examination. Gives results obtained using a continuous method of X-ray examination of steel blooms during rolling. ***W. Lückerath, K. Fink, and R. Flossmann.*** *Iron & Steel*, v. 33, no. 11, Oct. 1960, p. 500-504.

* **Investigations Into the Elementary Processes Occurring in Electric Spark Machining.** The erosion of the material is not determined primarily by the heating effect of the spark discharges. When using short pulses of 1 μs duration, effects of field strength or electrodynamical forces seem to be predominant. ***Margit Tóth-Bitskey and Jenő Pócza.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 12, no. 1, 1960, p. 77-83.

* **Coolant Performance Compared—Mist, Flood, Air.** Significant improvement of metal removal generally results from using mist coolant. Quantitative performance data reveal that flood cooling or dry cutting can provide better performance for certain feed and speed combinations. ***Dimitri Kececioglu and Arthur Sorensen, Jr.*** *Tool and Manufacturing Engineer*, v. 45, no. 5, Nov. 1960, p. 101-106.

* **Predicting Surface Finishes.** Predicting surface finish to high accuracy is possible using equations developed by the author. Or, if speed and ease of solution are more important than extreme accuracy, a graphic method of solution can be used. Only tool radius and feed data are required for solution. ***Robert D. Brown.*** *Tool and Manufacturing Engineer*, v. 45, no. 5, Nov. 1960, p. 81-82.

Fabrication of the PRTR Zircaloy-2 High Pressure Process Tubes. Through development of a fabrication process and the manufacture of 95 PRTR process tubes, it has been demonstrated that the commercial fabrication of high-quality Zircaloy-2 pressure tubing is feasible. ***R. L. Knecht.*** *U. S. Atomic Energy Commission, HW-60358*, July 31, 1959, 47 pp. (UF767 Un3.1hw Contin.)

The Nature of Lubrication in the Cold Rolling of Aluminium and Its Alloys. Roll force and forward slip were measured over a wide range of first-pass reductions on 0.080-in.-thick 99.99% Al, Al-1.25% Mn alloy, clad and unclad Al-Cu-Mg-Si alloy, Al-5% Mg alloy, and mild-steel strips on a 14.3 x 24-in. two-high rolling mill at a rolling speed of 43 ft/min, using either a straight mineral or a compounded oil. The mean coefficient of external friction was derived from various equations based on forward slip and roll force. Although the numerical value of μ depended on the computing method, conclusions were qualitatively quite unambiguous. While μ was largely independent of pass reduction in the rolling of steel, it increased rapidly with roll pressure when rolling Al and Al-Mn alloy. The increase was less when a compounded oil was employed and was rather limited with strong alloys, especially Al-5% Mg alloy. This behavior is attributed to differences in the tendency of the rolled materials to weld to steel. The ease with which Al can be pressure welded is assumed to lead to the formation of welded joints at the asperities of contacting surfaces, only partly prevented by boundary additives, and resulting in a marked rise of friction. The coefficient of friction was typically 0.034-0.045 for mild steel and varied from 0.02 to 0.3 for Al alloys. A very slight change from 3.0 to 1.8 μ in. C.L.A. in the surface roughness of the rolls had a noticeable effect in reducing friction. ***J. A. Schey.*** *Institute of Metals, Journal*, v. 89, pt. 1, Sept. 1960, p. 1-6.

* **The Development of Blooming and Billet Mills.** The development of blooming and billet mills in Russia over the last ten years and the prospects for future development depend on maintenance conditions at heavy iron and steelworks. ***M. L. Zaroshchinskii.*** *Stal' in English*, 1960, no. 6, June, p. 415-421.

* **Developments in Continuous Billet Mills.** With the present development of machinery construction, use should be made of high-output continuous billet mills with alternate horizontal and vertical stands. Only in the event of a limited output and a restricted rolling programme is it an advantage to construct mills with horizontal stands only and edging roller guides. ***E. A. Zhukevich-Stosha and O. P. Solov'ev.*** *Stal' in English*, 1960, no. 6, June, p. 421-425.

* **The Effects of the Kinematics of a Tube Cold Rolling Mill.** The change in the kinematics of a cold rolling mill with the introduction of double rotation of the tube, in advance of both the backward and the forward movements of the stand, has made it possible to reduce considerably the forces of deformation, to improve the quality of the tubes, and to increase mill output. ***Yu. F. Shevakin and F. S. Seidaliev.*** *Stal' in English*, 1960, no. 6, June, p. 427-428.

Casting Variables Affecting the Machinability of Grey Iron. The machinability of cast iron is related to the microstructure, rather than to the usual criteria of hardness and strength. The influence of chemical factors on microstructure is explained chiefly on the basis of the tendency of each constituent element to accelerate or inhibit graphite formation during solidification. Discusses the influence on machinability of such physical factors as pouring temperature, rate of cooling, mold conditions, and inoculation practice. ***E. A. Loria.*** *Metallurgia*, v. 62, Sept. 1960, p. 103-107.

Development of Cold-Rolling Lubricants for Aluminium Alloys. The requirements that should be met by a cold-rolling lubricant are stated, and an account is given of an investigation to develop improved lubricants. To enable the lubricants to be evaluated, tests for "reduction capacity", staining, surface finish, and stability are devised. A good correlation was found between these tests and the performance of lubricants in a rolling mill. The tests were used to correlate the reduction capacity, staining, and stability of various lubricants with the physical and chemical characteristics (particularly structure and composition) of the base oils and additives from which the lubricants are compounded. Specification for a satisfactory cold-rolled lubricant is formulated. ***R. D. Guminski and J. Willis.*** *Institute of Metals, Journal*, v. 88, pt. 12, Aug. 1960, p. 481-492.

* **Extensometer Eases Strip Hardening Control.** Simple digital instrumentation employing all-static system assures quality control of temper mill products. ***Rene C. Lopez.*** *Allis-Chalmers Electrical Review*, v. 25, no. 3, 1960, p. 4-7.

* **Study of Cutting Process at Very High Speeds.** A laboratory device used in studying metal cutting at 100-700 m/sec is described. During abrasion-cutting of Al and duraluminum, the changes in cutting force, the shrinkage of the chip, its hardness, the depth of the cold-worked layer under the machined surface, and the weight of the cut chip at constant cutting depth were studied. The temperature of recrystallization in the cold-worked layers and other parameters were determined. (*In Russian.*) Izuchenie protsessa rezaniia pri sverkhvysokikh skorostiakh. ***V. D. Kuznetsov, G. D. Polosatkin, and M. P. Kalashnikova.*** *Fizika Metallov i Metallovedenie*, v. 10, no. 3, Sept. 1960, p. 425-434.

Cutting of Defects of Medium-Alloy Cr-Ni Steel Castings With the Oxygen-Acetylene Flame and With the Carbon Electrode. It is possible to successfully repair defects in alloy steel by flame cutting tears and cracks with the oxy-acetylene flame, as well as with the carbon electrode. In both cases, the results on welding up are quite satisfactory, though in some cases cracks appeared on the flame-cutted edge after grooving. It is necessary to use Type 18/8 austenitic electrodes for welding. (*In Czech.*) Vypalování vad u střednělegovaných Cr-Ni ocelových odlitků kysliko-acetylenovým plamenem a uhlíkovou elektrodou. ***Karel Mazanec and Lubomir Huvar.*** *Slévárenství*, v. 8, no. 10, Oct. 1960, p. 347-351.

* **Metalworking in Miniature . . . to Make Semiconductors by the Thousand.** A host of "conventional" (and a few quite novel) metalworking techniques are used, most of them scaled down to the submicroscopic. Pulling the ingot, slitting the ingot, finishing slices to size, cutting up the slices, sealing and joining, etching and plating are described. ***David Fishlock.*** *Metalworking Production*, v. 104, no. 44, Nov. 2, 1960, p. 71-76.

* **Vacuum Rolling Mill.** Rolling of difficulty deforming metals and alloys with a minimum thickness of the rolled sheets of 0.3 mm may be carried out successfully in this two-high reversing vacuum mill of modern design. (*In Russian.*) Vakuumnyĭ prokatnyĭ stan. ***V. M. Amonenko, A. S. Tron', V. V. Mukhin, and V. A. Tarasov.*** *Stal'*, v. 20, no. 10, Oct. 1960, p. 920-922.

Fluid Forming. The fluid-forming process described was developed by the Swedish aircraft firm, Svenska Aeroplan Aktiebolaget. It is an internal forming process, in which a rubber diaphragm under hydraulic pressure forces the sheet-metal blank into a cavity shaped to the external form of the part. ***H. Möller.*** *Aircraft Production*, v. 22, Nov. 1960, p. 424-432.

The Role of Friction in Metal Cutting. The experimental results for steel SAE 1112, at speeds up to 1010 fpm, reveal that friction under metal-cutting conditions on the rake face can be explained satisfactorily by a junction model with possible superimposed general plastic flow above the junctions in accordance with the general rules of plastic deformation. The experimental results also reveal that the friction mechanism at the controlled flank-wear contact area is essentially the same as that occurring at the tool face. ***S. Kobayashi and E. G. Thomsen.*** *ASME*,

Transactions, Series B, Journal of Engineering for Industry, v. 82, no. 4, Nov. 1960, p. 324-332.

* **A Comparison of Lubricants and Coatings for Cold Extruding Titanium.** Investigations were conducted on a number of surface coatings and lubricants, both experimental and commercial, as part of an over-all process development program on cold extrusion of solid and hollow Ti shapes. Materials were evaluated on the basis of surface finish and extrusion pressure in cold forward extrusion of unalloyed Ti billets 1½ in. in diameter to solid round bars 0.93 in. in diameter (60% reduction). A fluoride-phosphate chemical conversion coating proved to be most desirable from the standpoint of adherence, ease of application, and cost. The effectiveness of the coating in reducing extrusion pressure and producing a good surface finish was dependent on the lubricant used. Various types and combinations of lubricants, including graphite, molybdenum, disulfide, boron nitride, wax, soaps, polyalkylene, glycol, and sulfochlorinated mineral oil were used in conjunction with the coating. The solid films, wax, and soaps were both alone and suspended in several resin carriers. Of the various classes of materials, the solid-film lubricants produced the best surface finishes on the extruded bars. ***Alvin M. Sabroff and Paul D. Frost.*** *ASLE Transactions,* v. 3, no. 1, Apr. 1960, p. 61-68.

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

Some Elastic Properties of an Edge Dislocation Wall. A detailed elastic theory calculation is given to reveal the stress field of a dislocation wall consisting of a finite number of uniformly spaced edge dislocations of the same slip vector. The wall is normal to the slip plane. It is found that only at distances from the wall closer than the dislocation spacing in the wall does the stress field begin to resemble that of a simple tilt boundary or of a wall containing an infinite number of dislocations. At large distances from the wall, the stress field approaches that of a single dislocation with a Burgers' vector equal to the sum of the Burgers' vectors of all dislocations in the wall. Based on the calculated stress field, the process of polygonization is illustrated and some rate laws are suggested concerning the growth of a wall and the coalescence of two walls. The interaction of solute atoms with a finite dislocation wall is discussed in terms of the dilatational strain field which is also quite different from that of an infinite wall. The strain energy of a dislocation wall is calculated and compared with that of a set of randomly distributed dislocations to confirm the energetics of polygonization. Finally, some mechanical properties are discussed in terms of the ability of a dislocation wall to resist the penetration of approaching dislocations and its contribution to the brittleness of the material. ***James C. M. Li.*** *Acta Metallurgica,* v. 8, Aug. 1960, p. 563-574.

Effect of Hydrogen on Room-Temperature Mechanical Properties of Titanium-4·5% Aluminium-4·5% Manganese Alloy. The presence of H increased the strength slightly in tensile tests at both high and low strain rates, but the effect was small compared with that of a change in strain rate. Loss of ductility occurred only in tests at the low strain rate when the H content exceeded ~250 ppm. This embrittlement may be an effect of strain-aging. "Notched" tensile and stress-rupture tests did not indicate embrittlement clearly, and offered no advantage over conventional tensile tests at low strain rate. Hydrogen did not embrittle the alloy in the heat-treated condition used in this investigation at contents below the maximum amount (150 ppm) normally specified for commercial alloys. ***R. Haynes.*** *Institute of Metals, Journal,* v. 88, pt. 12, Aug. 1960, p. 509-512.

* **Nature of the Secondary Austenitic-Martensitic Reaction During Tempering in High Speed Steels.** When tempering fast-curing steel at 580 C, the composition of the residual austenite does not change. The impoverishment of the γ-phase revealed by X-rays examination during tempering beyond 580-600 C is accompanied by the appearance of troostite during subsequent cooling. While martensite is formed during hardening in the residual austenite a stress of the second type appears. (*In Russian.*) Priroda vtorichnoĭ austenitno-martensitnoĭ reaktsii

pri otpuske v bystrorezhushchikh staliakh. ***G. V. Korotushenko.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia,* 1960, no. 8, p. 128-137.

Sulfur Segregation at α-Iron Grain Boundaries. I.-II. Radioactive S was introduced simultaneously into single crystal and polycrystal specimens of high purity alpha Fe by reaction with H_2S. After lengthy annealing and rapid quenching, the polycrystals were found to contain 50-100 per cent more S than the single crystals, and the excess S in the polycrystals was found to be concentrated at the grain boundaries. All available evidence indicates that the sulfur was in solid solution at the equilibration temperature, although the amount of S segregated at the boundaries is much greater than can be accounted for on the basis of equilibrium adsorption. I. ***N. G. Ainslie, R. E. Hoffman, and A. U. Seybolt.*** II. ***N. G. Ainslie, V. A. Phillips, and D. Turnbull.*** *Acta Metallurgica,* v. 8, Aug. 1960, p. 523-528.

On the Slip Line Pattern of Face-Centered Cubic Metal Crystals. Using Cu as an example, the so-called normal slip line pattern of face-centered cubic metal crystals is discussed. The normal pattern is perturbed by the appearance of striae and kink bands. Their variation with strain is examined, particularly in relation to stages I, II, III of the stress-strain curve. The striae turn out to be a coarse form of the strain inhomogeneities, which are observed by the electron microscope in the "structurized fine slip" of stage II. Two different types of kink bands, associated with two modes of formation, have to be distinguished. One of these types occurs in stage III of the stress-strain curve only. It is a consequence of the thermally activated cross slip occurring in stage III. It is shown that the fragmentation (cell formation) of deformed crystals is a closely related phenomenon. (*In German.*) Untersuchung des Gleitlienbildes Kubisch-Flächenzentrierter Einkristalle. ***S. Mader and A. Seeger.*** *Acta Metallurgica,* v. 8, Aug. 1960, p. 513-522.

An Effect of Impurity Atoms on the Energy Relationship of (100) and (110) Surfaces in High Purity Silicon Iron. The migration of grain boundaries between (110) grains and (100) grains in high purity 3% Si-Fe sheet was investigated at 1200 C to determine whether or not impurity atoms could affect a reversal in the direction of boundary migration. Boundaries were found that advanced into the (100) grains in a vacuum anneal, than reversed their direction of migration and advanced into the (110) grains in a subsequent anneal in impure Ar, and then reversed back to the initial direction of migration in a final vacuum anneal. Evidence was found for surface energy driving forces in both kinds of anneals. In the anneals in Ar, but not in vacuum, the surfaces of the (100) grains were thermally etched. The results could be satisfactorily explained on the basis that the impure Ar supplied O atoms and that the vacuum anneals removed O. The conclusions reached were (a) under proper conditions impurity atoms can effect a reversal in the direction of boundary migration, (b) $\gamma_{110} < \gamma_{100}$ in the vacuum anneals and $\gamma_{100} < \gamma_{110}$ in the anneals in impure Ar, (c) the effect of the impurity is to reduce γ_{100} more than γ_{110} and (d) the high density plane, (110), is not always the low energy plane. ***J. L. Walter and C. G. Dunn.*** *Acta Metallurgica,* v. 8, Aug. 1960, p. 497-503.

Low Temperature Calorimetric Measurements on Isothermal Aging of Al-Ag. On quenching Al containing 1.3 at.% Ag, energy is released upon isothermal holds at low temperatures (~245 K). The amount of energy evolved, over a measured period of time (32-140 min) after the initiation of the reaction (clustering of Ag atoms), amounts to 6-7 cal/g-atom of alloy for "slow" quenches and about 2-2.5 cal/g-atom of alloy for "fast" quenches. These results are consistent with the resistometric studies of Turnbull, et al., who pointed out the existence of two states in quenched Al-Ag alloys. ***W. DeSorbo.*** *Acta Metallurgica,* v. 8, Aug. 1960, p. 539-541.

The Absorption and Effusion of Hydrogen in Alpha Iron. Rates of absorption and effusion of H in solid Fe were measured by a Sieverts type of apparatus. With clean α-iron these rates are diffusion controlled down to 420 C and are represented by the equation $D = 6.70 \times 10^{-4}\ e^{-1100/T°K}\ cm^2\ sec^{-1}$. Certain surface impurities can affect these rates at all temperatures. Thin oxide films lower the apparent diffusivity as annealed iron markedly. Cold-worked iron (75%) annealed at 430 C has practically the same solubility and diffusivity as annealed iron. ***D. C. Car-***

michael, J. R. Hornaday, A. E. Morris, and N. A. Parlee. *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 826-832.

* **Study of the Coprecipitation of Palladium and Tellurium; Comparison of the Coprecipitates With the Alloys Obtained by the Thermal Method.** The induced precipitations observed between Pd and Te and between Pd and Se, during reduction, cause the appearance of different phases which reproduce the alloys obtained by the thermal method. In particular, a solid Te solution is formed in Pd, as is shown by heating the elements in a vacuum at 900 C. (*In French.*) Étude de la coprécipitation du palladium et du tellure; comparaison des coprécipités aux alliages obtenus par voie thermique. ***Marcelle Segui-Cros and Henri Triché.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 10, Sept. 5, 1960, p. 1127-1129.

* **Equilibrium in the Titanium-Tin System.** Between the α-Ti and γ-phase, there is an uninterrupted series of solid solutions. An equilibrium diagram in the interval of concentrations between 0 and 25 at.% Sn was drawn. Sn addition lowers the temperature of the allotropic transformation of Ti to a minimum at 842 C and 6.52 at.% Sn, then it raises the temperature. (*In Russian.*) O ravnovesii v sisteme titan-olovo. ***V. V. Glazova and N. N. Kurnakov.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1087-1090.

Precipitation Processes in Copper-Rich Copper-Iron Alloys. Precipitation processes occurring during both furnace cooling and aging of copper-iron alloys were studied by means of electrical and magnetic measurements. On furnace cooling, two distinct stages in the precipitation process were detected; one occurring above and the other below 850 C. The kinetics of precipitation from quenched alloys were studied between 200 and 700 C. The reaction appears to be consistent with the concept of nucleation of precipitate particles at dislocation loops formed by the clustering of quenched-in vacancies. ***A. Boltax.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 812-821.

* **Influence of Alloying Elements Having Marked Solubility in Nickel-Chromium Solid Solutions on Properties of Heat-Resisting Alloys.** Strengthening interatomic bonds in the solid solution by additions of Mo, W, V, or Co. (*In Russian.*) Vliianie na svoĭstva zharoprochnykh splavov legiruiushchikh elementov, obladaiushchikh znachitel'noĭ rastvorimost'iu v nickel'-khromovom tverdom rastvore. ***M. V. Pridantsev and G. V. Estulin.*** *Stal'*, v. 20, no. 10, Oct. 1960, p. 936-946.

* **The Influence of Time of Aging on Formation and Composition of the γ'-Phase in the Ni-Cr-W-Al-Ti System.** The chemical composition of the γ'-phase is cited in a table. For the investigation of the distribution of elements between the phases, the authors carried out a balancing of the products of electrolysis for the alloy, which was aged during 1000 hours, and calculated the content of elements in weight per cents in the γ-nickel solid solution in the γ'-phase. (*In Russian.*) Izuchenie vliianiia vremeni stareniia na obrazovanie i sostav γ'-fazy v splavakh sistemy Ni-Cr-W-Al-Ti. ***R. B. Golubtsova and L. A. Mashkovich.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 6, Oct. 1960, p. 1353-1355.

* **Martensite Transformations in the Titanium-Zirconium System.** On the basis of 10 analyses where the ω phase was discovered, it was found that on hardening, the ω phase forms up at a certain electron concentration of the alloying element and at a certain value of the difference between the number of vacancies and the number of s-electrons which are found in the alloy. (*In Russian.*) Martensitnye prevrashcheniia v sisteme titan-tsirkoniĭ. ***V. N. Gridnev, V. I. Trefilov, and V. N. Minakov.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 6, Oct. 1960, p. 1334-1336 + 1 plate.

The Aging Characteristics of the Ti-13V-11Cr-4Al Alloy. Aging characteristics of a titanium alloy containing 13% V, 11% Cr, and 4% Al were investigated by hardness measurements, X-ray diffraction, and metallography. The β phase decomposes into β + α and β + α + $TiCr_2$ above about 1050 F; below this temperature a transition phase, believed to be ω, precipitates first, followed by α and $TiCr_2$. The observed hardening is attributed to these reactions. Cold working of solution-treated specimens accelerates hardening and raises the hardness level attained. A *TTT* diagram is proposed. ***R. A. Rawe, J. M. Dupouy, and M. B. Bever.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 821-825.

Kinetics of Exchange Reactions Between Liquid Bismuth-Rare Earth Alloys and Fused Salts. Measurements were made of the over-all rates of the exchange reaction between a Bi-Mg-Sm alloy and the NaCl-KCl-$MgCl_2$ eutectic at 500 C, using the falling liquid drop technique. The data are in agreement with the theoretical predictions of a model in which it is assumed that the over-all reaction rate is controlled by mass transfer processes. Further experiments are required to confirm the validity of the model. ***H. M. Katz, F. B. Hill, and J. L. Speirs.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 770-775.

Identification of Chi and Sigma Phases in Stainless Steel With the Electron Probe Microanalyzer. Direct identification *in situ* of χ and σ phase precipitates in stainless steel is possible with the electron probe microanalyzer. Although particles in the 1 μ size range are too small to yield absolute percent composition, the relative % Cr/% Mo ratio can be used to distinguish the two phases with better than 95% confidence. Wet chemical analysis of extracted residues gives Cr/Mo ratios in good agreement with electron probe results extrapolated to the 4 to 5 μ size range. ***L. S. Birks, J. M. Siomkajlo, and P. K. Koh.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 806-809.

Plutonium-Aluminum Solid Solubility and Diffusion Studies. The solid solubility and diffusion of Pu in Al were studied at 600 C. Cylindrical diffusion couples were prepared by coextrusion, and consisted of a core of 7 wt.% Pu-93% aluminum alloy clad with Al. Quantitative autoradiography and metallography were utilized to determine the solid solubility, and metallographic measurement furnished data for calculation of a diffusion coefficient. ***Arthur E. Hall.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 283-288.

* **Kinetics of Eutectic Crystallization of Iron-Carbon Alloys.** The isothermal crystallization of eutectic iron-carbon alloys was studied at 1120-1000 C. The kinetic diagram of eutectic crystallization is plotted. The diagram gives the position of lines of the beginning of crystallization of austenite, graphite, and cementite, as well as the lines of the end of the crystallization of the liquid. (*In Ukrainian.*) Kinetyka evtektychnoyi krystalizatsiyi zalizovugletsevych splaviv. ***K. P. Bunin and L. T. Kalinina.*** *Akademiia Nauk Ukrains'koĭ RSR, Dopovidi*, 1960, no. 9, p. 1231-1235.

* **Solubility of Silicon Carbide in Iron-Silicon Alloys.** A study of the interaction of SiC with other ferroalloy components established conditions for the solubility of this carbide in carbon-free silicon alloys. ***V. A. Kravchenko and S. I. Khitrik.*** *Stal' in English*, 1960, no. 6, June, p. 413-415.

The Tantalum-Rhenium System. A constitutional diagram is proposed for the Ta-Re alloy system. Rhenium dissolved in Ta up to 48 wt.% and the maximum solubility of Ta in Re is 5 wt.%. Intermediate χ and σ phases were found. X-ray diffraction, metallography and melting points were employed. ***J. H. Brophy, P. Schwarzkopf, and J. Wulff.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 910-914.

Measurement of Kirkendall Effect in the Iron-Chromium System. Markers in a diffusion couple in the Fe-Cr system move towards the high Cr side indicating $D_{Cr}^{*} > D_{Fe}^{*}$ at the marker composition. By a combination of measurements of D_{Cr}^{*} and D as a function of composition, this is also shown independently. D_{Fe}^{*} is calculated as a function of composition, and shown to be in reasonable agreement with measured values by other workers. ***H. W. Paxton and E. J. Pasierb.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 794-796.

Rates of Growth of Cementite in Hypereutectoid Steels. The growth of grain boundary films and Widmanstätten plates of proeutectoid cementite in hypereutectoid steels was considered quantitatively in three plain carbon steels and one "pure" iron-carbon alloy. Growth was found to take place at a slower rate than would be predicted on the basis of a model invoking rate control by long range diffusion of C. The films in the pure alloy grew faster than those in the plain carbon steels. A possible explanation is suggested. ***R. W. Heckel and H. W. Paxton.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 5, Oct. 1960, p. 799-806.

Precipitation in Commercial Copper-Beryllium Alloys. An investigation of the type of precipitate occurring in the range 300-550 C was made on four commercial Cu-2% Be alloys. Between 380 and 500 C most of the precipitate formed has a lamellar structure. *TTT* curves were determined for this precipitate, and it was found that Turnbull's theory (Acta Met., 1955. 3, 55) considerably overestimates the rate of growth. The effects of grain size and cold work on the formation of the lamellar precipitate have been studied. If the lamellar precipitate is present in material given normal age-hardening treatments, the strength and hardness are reduced and the ductility is increased. ***A. R. Entwisle and J. K. Wynn.*** *Institute of Metals, Journal,* v. 89, pt. 1, Sept. 1960, p. 24-29.

Domains in Thin Magnetic Films Observed by Electron Microscopy. A new method for observing full domains in thin magnetic films by electron microscopy. Observations were made with standard transmission instruments utilizing an off-centered objective aperture diaphragm as a knife edge. The method has the high-resolution advantage that the microscope is focused on the specimen during domain observations. Limitations of the method and comparisons with the previously reported defocusing technique are presented. Applications to the interpretation of complex domain patterns and cross-tie walls are demonstrated. ***Harrison W. Fuller and Murray E. Hale.*** *Journal of Applied Physics,* v. 31, Oct. 1960, p. 1699-1705.

Ordering in the Intermediate Phases TiFe, TiCo, and TiNi. The intermediate phases were investigated by X-ray powder diffraction techniques. The atomic arrangements of these ensembles were determined to be of the cesium chloride, B2 type. Monochromatic x radiation was utilized in the investigation. ***Paul Pietrokowsky and Frank C. Youngkin.*** *Journal of Applied Physics,* v. 31, Oct. 1960, p. 1763-1766.

On a Complex Recrystallization Texture in 3% Silicon Iron. Components in a complex primary recrystallization texture, which is a matrix texture for secondary recrystallization to the Goss texture in 3% Si-Fe strip, were determined by the axis-chart method of Jetter, McHargue, and Williams. Results are compared with former pole-figure results and found to include components not previously resolved or noted. Components of the texture explain reasonably well the observed magnetic torque curve of the material. ***C. G. Dunn and C. J. McHargue.*** *Journal of Applied Physics,* v. 31, Oct. 1960, p. 1767-1771.

* **Effects of Additions of a Third Constituent on the Aging of the Aluminum-Silver Alloy.** Analysis of the abnormal X-ray dispersion revealed that additions of Cu and Si in the Al-Ag alloy (5.9 at.%) are uniformly distributed through the entire alloy; Mg and Zn additions preferably penetrate into the zones. The effect on the strength of the Guignet-Preston zones was also studied. (*In Russian.*) Vliianie dobavok tre'ego komponenta na starenie splava aluminiĭserebro. ***R. R. Zakharova and N. I. Buinov.*** *Fizika Metallov i Metallovedenie,* v. 10, no. 3, Sept. 1960, p. 375-381.

Lattice Spacings in Thorium - Yttrium Alloys. The lattice spacings observed for Y were $a = 3.6441$, $c = 5.7358$ kX. Solution of Th increases the *c*-spacing and decreases the *a*-spacing. By contrast the lattice spacing of Th is only very slightly affected by the solution of Y. From the results of the lattice spacing measurements, and from those of a metallographic examination, the two-phase region between the cubic and hexagonal solid solutions extends from 49 to 69 at.% Y. ***D. S. Evans and G. V. Raynor.*** *Journal of Nuclear Materials,* v. 2, no. 3, Sept. 1960, p. 209-215.

Constitution of Low Carbon U-C Alloys. The U-C phase diagram at low C concentration was determined by saturation

experiments, thermal analyses and metallography. The system has an eutectic point of 0.98 at.% C at 1116.6 C and two eutectoid reactions: $U_{(\gamma)} \rightleftharpoons U_{(\beta)} + UC$ and $U_{(\beta)} \rightleftharpoons U_{(\alpha)} + UC$, at 771.8 C, and 665.9 C, respectively, 3.0 and 1.8 C below the transformation temperatures of the pure metal. The γ solubility decreases from 0.30 ± 0.075 at.% at the eutectic temperature to 0.09 ± 0.04 at.% at the eutectoid temperature. The solubility of C in β U is probably less than 10 ppm by weight, in α U less than 3 ppm. ***Bernhard Blumenthal.*** *Journal of Nuclear Materials,* v. 2, no. 3, Sept. 1960, p. 197-208.

* **Proposed Transformations in Pure Chromium.** Evidence for the existence of the numerous proposed allotropic modifications of Cr is reviewed. It is concluded that only the normal body-centered cubic form is in any way firmly established at the present time. ***A. R. Edwards.*** *Australian Institute of Metals, Journal,* v. 5, no. 2, Aug. 1960, p. 182-185.

* **Irradiation Induced Phase-Transformations in Metals & Alloys.** The effects of neutron irradiation on order-disorder, precipitation, phase-reversal, and martensitic reactions are discussed in relation to theories of radiation damage. ***R. Smith.*** *Australian Institute of Metals, Journal,* v. 5, no. 2, Aug. 1960, p. 163-172.

Nucleation and Growth of Gas Bubbles in Irradiated Metals. Several metals undergo nuclear reactions when subjected to neutron irradiation which result in the formation of gases in the metal. At elevated temperatures these gases tend to nucleate and form gas bubbles which result in over-all increases in volume in the material, and which can have important technological implications. The available experimental data on this phenomenon is summarized, attention being concentrated on the cases of krypton and xenon in U and He in Be. Current theories of nucleation and growth, developed for the case of the rare gases in U, are reviewed. Some comments are made on the application of these theories to Be. ***B. S. Hickman.*** *Australian Institute of Metals, Journal,* v. 5, no. 2, Aug. 1960, p. 173-181.

* **Allotropic Transformations in Dilute Alloys Based on Iron, Titanium and Zirconium.** Phase boundaries for dilute alloys have been used to estimate values of ΔH_x, the difference between the enthalpies of solution of an alloying element in the allotropic forms of the solvent metal. Periodic variations of ΔH_x values have been examined and the influence of atomic size factors, electro-negativity and valency on the allotropic transformation ranges have been assessed. There are indications that the $\alpha \rightleftarrows \gamma$ range in iron-base alloys may be slightly influenced by the metallic valency of the alloying element, and whether the added element has a "full" or "open" atomic structure according to Hume-Rothery's definition. There is definite evidence that valency and Brillouin zone factors are significant as affecting the relative stabilities of the hexagonal and cubic structures in dilute alloys based on Ti and Zr. Elements which form interstitial solutions are not considered. ***H. W. Worner.*** *Australian Institute of Metals, Journal,* v. 5, no. 2, Aug. 1960, p. 154-162.

* **The Ageing Characteristics of Complex Al-Zn-Mg Alloys. Distinctive Effects of Copper and Silver on the Ageing Mechanism.** A study of the effects of Cu, Ag, and Au on the aging characteristics of selected Al-Zn-Mg alloys. Hardness-aging-time curves were determined within the range -20 to 270 C and the results supplemented by metallographic observations. Both Cu and Ag appear to have an intrinsic effect on the aging processes of several of the ternary alloys. Copper influences the early stages of aging, the most notable effect being the rapid early hardening which occurs in some alloys aged in the range 100-235 C. This phenomenon appears to be quite distinct from the basic aging processes of the equivalent ternary alloys, and is considered to be associated with the formation of the S phase (Al_2CuMg). The effects of Ag are confined to the second stage of the aging sequence and are very marked in the Al-4%-Zn-3% Mg alloy. Nucleation of this phase is facilitated, so that it is present as a very finely dispersed precipitate. This dispersion is stable to a relatively high temperature, with the result that overaging is retarded. Observations on a quinary alloy containing both Cu and Ag showed that the effects of these elements were independent and additive, with a resultant increase in the degree of age-hardening. Gold has no observable effects on account of its negligible solid solubility. ***I. J. Polmear.*** *Institute of Metals, Journal,* v. 89, pt. 2, Oct. 1960, p. 51-59.

* **New Carbide Formed During the Transformation of Carbon-Silicon Steels.** The C-Si steels subjected to a bainitic transformation between 350 and 450 C yield a new carbide having its Curie point near 370 C. The isothermal decomposition of austenite toward 400 C occurs in two successive stages: in the first, ferrite is developed whereas C increases in the austenite; in the second, the remaining austenite is decomposed into ferrite and this into carbide. (*In French.*) Nouveau carbure se formant dans la transformation d'aciers au carbone-silicium. ***Jacques Pomey, et al.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 15, Oct. 10, 1960, p. 1507-1508 + 2 plates.

Physical and Engineering Properties of Cast Iron. A Data Book for Engineers and Designers. Constitution and structure of cast iron, mechanical, physical and electrical properties of cast iron, general properties of commercial cast irons, special properties affecting service, heat treatment of grey cast iron, internal casting stresses, components with high local loadings, cast iron beams, columns, pipes, cylinders, and pressure vessels, applications of specifications and data to design are discussed. ***Harold T. Angus.*** 528 pp. 1960. The British Cast Iron Research Association, Alvechurch, Birmingham, England. (TA474 An48p)

* **The Kinetics of Martensitic Transformations.** The term "martensitic transformation" is applied to phase changes which are displacive, or shear-like in nature. Individual reactions of this type show wide variations in the kinetics of the transformation, and this places severe restrictions on any attempt to formulate a general theory to explain their nature. Of the various theories which have been advanced, it would appear that the kinetic model based on the existence of a barrier to the rapid growth of pre-existing martensitic embryos is in best agreement with experimental observations, although no fully satisfactory explanation for the genesis of these embryos has been put forward to date. ***D. G. Walker and D. W. Borland.*** *Australian Institute of Metals, Journal*, v. 5, no. 2, Aug. 1960, p. 75-89.

* **Crystallographic Aspects of the Bainite Transformation.** The phenomenological theory of martensitic transformations is used to examine the hypothesis that the crystallographic features of bainite arise during the formation of a supersaturated ferrite. It is proposed that the direction of the second shear is $[\bar{1}10]_F$ and stereographic methods are developed that enable the habit planes and orientation relationships to be predicted for any proposed shear plane in the zone $[\bar{1}10]_F$. Although the agreement between theory and experiment is probably satisfactory for lower bainite, the hypothesis cannot account for the occurrence of habit planes near $\{111\}_F$ in upper bainite. The need for experimental determinations of the specific indices of bainite habit planes is emphasized. ***J. S. Bowles and N. F. Kennon.*** *Australian Institute of Metals, Journal*, v. 5, no. 2, Aug. 1960, p. 106-113.

* **A "Super Elastic" Alloy Based on the Martensite Transformation.** Elastic strains of up to 4% can be attained in a copper-aluminum-nickel alloy in the form of a single crystal suitably heat treated. The high elasticity is due to a reversible martensite transformation induced by stressing. ***W. A. Rachinger.*** *Australian Institute of Metals, Journal*, v. 5, no. 2, Aug. 1960, p. 114-117.

* **The Effect of Small Chromium Contents on the Isothermal Transformation Rates of Steel Wire.** The effect of Cr in residual amounts on the isothermal transformation rates of 0.70% carbon steel wires is shown to depend on the temperature of transformation and upon the austenizing treatment employed. In the vicinity of the nose of the TTT curve, longer times and higher temperatures of austenization reduce the transformation rate and magnify the effects of Cr. This is most probably due to grain growth, although the dispersion of C concentration gradients may play a part. No intrinsic effect of austenizing temperature is observed at 550 C. ***G. G. Brown and H. C. Coe.*** *Australian Institute of Metals, Journal*, v. 5, no. 2, Aug. 1960, p. 118-122.

* **Phase Transformations Accompanying the Formation of AB Superlattices.** Recent work on the kinetic and crystallographic aspects of the transformations accompanying the formation of AB superlattices in face-centered-cubic alloys is reviewed. The cubic to tetragonal and the cubic to orthorhombic transformations that occur in both copper-gold and cobalt-platinum alloys (with compositions CuAu and CoPt respectively) are considered in some detail and some observations on the geometry of the pyramidal groups of orthorhombic plates in CuAu are described. Attention is drawn to the fact that these transformations are the only ones known in which the martensitic type of interface between initial and final lattices is superseded by a different type at a lower temperature. ***J. S. Bowles and A. S. Malin.*** *Australian Institute of Metals, Journal*, v. 5, no. 2, Aug. 1960, p. 131-139.

* **Phase Changes in Titanium Alloys.** The general effects of alloying on the allotropic transformation in pure Ti are summarized, and features of phase changes stemming from these effects are discussed under the headings martensite transformation, martensite decomposition, metastable beta phase decomposition on isothermal quenching and on reheating, and hydride precipitation. ***I. R. Lamborn.*** *Australian Institute of Metals, Journal*, v. 5, no. 2, Aug. 1960, p. 140-148.

* **The M_s Points of Binary Titanium Alloys.** An apparatus was developed for thermal analysis during rapid cooling at rates up to 5000 C/sec. Using this apparatus, the effect of additions of Mo, V, Nb, Fe, Mn, Cr, Co, Ni, Cu, Pb, Bi, Pt, Ag, Al, and Sn on the M_s temperature of Ti was measured. All elements except Ag, Pt, Al and Sn lowered the M_s temperature progressively. The effectiveness of the various additions is discussed in terms of the interatomic distances of these elements compared with that of Ti. ***Tomo-o Sato, Seikiti Hukai, and Yen-Chien Huang.*** *Australian Institute of Metals, Journal*, v. 5, no. 2, Aug. 1960, p. 149-153.

Electron Microscope Observations on the Annealing Processes Occurring in Cold-Worked Silver. Electron microscope observations on the dislocation structure of cold-worked polycrystalline silver and on the processes occurring during annealing are described. In silver deformed 25% in tension the dislocations are arranged in a cell structure and the stored energy is released in two stages, a recovery stage followed by recrystallization. During the recovery stage there is no observable change in the dislocation distribution but there is a possibility of small-scale dislocation rearrangements within the cell boundaries. Recrystallization occurs by the migration of the grain boundaries originally present in the metal and this process is discussed in some detail. Observations made on heavily rolled sliver annealed either inside the electron microscope on a heating stage or outside the microscope are also described. ***J. E. Bailey.*** *Philosophical Magazine*, v. 5, ser. 8, Aug. 1960, p. 833-842.

The Atomic Diffusion of Platinum in Gold. Measurements are reported of the diffusion of Pt at tracer concentrations in Au over the temperature range 800 C to close to the melting point of Au. Above about 900 C the results obtained can be fitted to the following equations: $D = (7.6 \pm \frac{4.7}{2.9}) \exp[-(60{,}900 \pm 1200)/RT]$ cm²/sec. The magnitude of the observed activation energy relative to that corresponding to self-diffusion in Au is in qualitative agreement with current theories. Below about 900 C the observed diffusion coefficients appear to be enhanced relative to those expected by extrapolation from higher temperatures; possible explanations of this effect are discussed. ***A. J. Mortlock, A. H. Rowe, and A. D. Le Claire.*** *Philosophical Magazine*, v. 5, ser. 8, Aug. 1960, p. 803-814.

The Plutonium-Zirconium Phase Diagram. The entire Pu-Zr phase diagram has been investigated from room temperature to 1300 C. The main features of the diagram are: continuous solubility between ϵ-Pu and β-Zr; a wide δ-Pu phase field extending across the diagram to 70 at.% Zr at 600 C; a maximum solubility of Pu in α-Zr of 13 at.% at 618 C, and other. The δ-Pu structure may readily be retained by quenching samples with compositions between 5 at.% and 70 at.% Zr, but is not an equilibrium phase below 267 C. ***J. A. C. Marples.*** *Journal of the Less-Common Metals*, v. 2, no. 5, Oct. 1960, p. 331-351.

Frictional Stress Acting on a Moving Dislocation in an Otherwise Perfect Crystal. The level of frictional stresses obtained is much higher than reported previously. Since common

glide dislocations in metals with close packed structures apparently do not suffer significant frictional stresses, mechanisms are discussed which tend to reduce their effect. A new such mechanism is discovered. ***Doris Kuhlmann-Wilsdorf.*** *Physical Review*, v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 773-781.

Resistance to Deformation of Super-Pure Aluminium at High Temperatures and Strain Rates: Determination From High-Temperature Torsion Data. Super-pure Al has been deformed in torsion over the range 195-55 C at shear strain rates from 0.86 to 7.1/sec. The data are used to calculate true-stress/-true-strain curves. ***H. Ormerod and W. J. McG. Tegart.*** *Institute of Metals, Journal*, v. 89, pt. 3, Nov. 1960, p. 94-96.

METALS—POWDER

The Fabrication of Boron by Powder Metallurgical Techniques. An investigation into the fabrication of shapes, with a view to the use in nuclear reactors of control rods of this material, has shown that B-rich alloys containing about 10 wt.% of such metals as Ni, Cu, and Mn, can be fabricated by a simple hot pressing technique. ***P. Best and S. R. Twigg.*** *Metallurgia*, v. 62, Oct. 1960, p. 146-152.

* **Hoeganaes Iron Powder Handbook. v. I-II. Basic Data.** Presents various methods for the production of iron powder, properties, commercial importance, and technical use of iron powders. Thermal treatment, lubrication, alloying additives of iron powders powder compacting methods various tooling principles, tool design, materials and methods for tool making, the toolroom, sizing and coining, metal powder presses, thermal treatment prior to sintering, basic aspects of sintering, sintering atmospheres, general aspects on the design of metal powder parts, joining, peen plating, layout of pilot plant, layout of an extensible production plant are discussed. Individually paged. 1957-1958. Hoeganaes Sponge Iron Corp., Riverton, New Jersey. (TN695 H67h)

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

Inspection and Testing of Aluminium Welds. A review of the various tests which are available and their respective fields of application. ***J. G. Young.*** *Light Metals*, v. 23, Sept. 1960, p. 248-252.

* **Investigation of an Electrical Non-Destructive Method of Measuring the Depth of Surface Hardness in Flame-Hardened Steels.** The electrical method investigated is an a.c. one, based upon the measurement of the complex impedance of a search coil magnetically coupled to the test surface. Distinctly favorable results were obtained, and the paper is concerned with the theoretical and practical aspects of the procedure. ***J. A. Betts and J. P. Newsome.*** *Institution of Electrical Engineers, Proceedings*, v. 107, pt. C, no. 12, Sept. 1960, p. 265-271.

* **Determination of Internal Ingot and Bloom Defects (Shrinkage Cavities) by Means of Gamma-Rays.** The relation for determination of the optimum control parameters is cleared up, the validity of which was verified by tests on specimens with artificial defects. Shows the indication of a natural axial defect. The real form of defect was controlled by cross sections in marked spots. (*In Czech.*) Zjišťování vnitřních vad (staženin) ingotů a předvalku prozařováním. ***F. Khol and J. Schmied.*** *Hutnické Listy*, v. 15, no. 10, Oct. 1960, p. 763-765.

* **How to Use Radiography in Pipeline Construction.** ***J. R. Strebelle.*** *Welding Engineer*, v. 45, Oct. 1960, p. 44 + 1 page.

A Nondestructive Assay Device for Highly Enriched Fuel Assemblies. An instrument has been developed which can nondestructively determine the U^{235} and B content of highly enriched, unirradiated fuel assemblies in five to fifteen minutes per element. Two nuclear measurement methods are used: counting of the natural radioactivity of U^{235}, and neutron attenuation measurements. ***Richard V. Babcock and Stanley L. Ruby.*** *Nuclear Science and Engineering*, v. 8, Nov. 1960, p. 410-415.

* **Quality Control, Fall 1960: Latest (and Best) Ideas.** Three jobs are noted for the best control: standardizing, communicating, organizing. *Textile World*, v. 110, no. 11, Nov. 1960, p. 69-72.

Ultrasonic Inspection of Small-Diameter Tubing. Advantages and shortcomings of ultrasonic testing techniques for tubing having diameters as small as 10 mm. ***W. Grabendörfer.*** *Henry Brutcher Translation No.* 4816, 5 pp. + 2 tables. (from *Mitteilungen Vereinigung Grosskesselbesitzer*, no. 64, Feb. 1960.) Henry Brutcher, Altadena, Calif.

* **Non-Destructive Testing. Ultrasonic Methods. II.** The beam angle, absorption of ultrasonic energy, and angle probe skip distance (flat sheets and tubes) are discussed. ***W. E. Schall.*** *Instrument Practice*, v. 14, Nov. 1960, p. 1181-1188.

* **Does a Radiographed Vessel Cost More to Build Than One That Isn't?** Some pressure vessel builders still believe that radiography takes money out of their pockets. An expert disproves this notion and proves that radiography is an economic necessity. ***Robert Chuse.*** *Welding Design & Fabrication*, v. 33, Nov. 1960, p. 31-33.

* **Split and Crack Detecting by Ultraviolet Fluorescence.** Process is improved by using fluorescent impregnating liquids and a Hg vapor lamp. The most suitable impregnating liquid is a mixture of yellowish green MC dissolved in petroleum and Rhodamin B dissolved in alcohol, both in equal amounts. The best absorbent powders, for reinforcing, are levigated alumina and very fine-grained talc. The method is suitable for all materials, whether magnetic or not, whether conducting or insulating. (*In French.*) Détection des criques et des fissures par fluorescence ultraviolette. ***F. Gobin.*** *Chimie & Industrie*, v. 84, no. 4, Oct. 1960, p. 532-550.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

Angular Distribution of Fragments in Fission Induced by Mev Neutrons. A multiangle gas-filled counter has been used to measure the fragment angular distribution in fission induced by neutrons in the energy range $0.5 \leq E_N \leq 9$ Mev. The target nuclei used were: Th^{230}, U^{233}, U^{234}, U^{235}, U^{236}, U^{238}, Np^{237}, and Pu^{239}. In the cases of U^{233} and U^{235} the neutron energy range was extended to include energies between 14.8 and 23 Mev. ***J. E. Simmons and R. L. Henkel.*** *Physical Review*, v. 120, 2nd ser., no. 1, Oct. 1, 1960, p. 198-210.

Energy Levels of He^5 and Li^5. The energies of the first three levels in He^5 are determined using a variational procedure. The various wave functions adopted incorporate alpha, triton, and deuteron correlations. The resultant energies and structures of these levels are in accord with the experimental situation. It should be stressed that our wave functions differ appreciably from the standard shell-model ones in the intermediate-coupling picture. ***L. D. Pearlstein, Y. C. Tang, and K. Wildermuth.*** *Physical Review*, v. 120, 2nd ser., no. 1, Oct. 1, 1960, p. 224-234.

Massless Particles. Gives a discussion of massless particles, especially the two-component neutrino and the photon, in the light of modern ideas about space reflection. The emphasis is on the physical arguments and mathematical details are omitted. ***R. H. Good, Jr.*** *American Journal of Physics*, v. 28, no. 7, Oct. 1960, p. 659-666.

Applicaton of the Phase Space Quasi-Probability Distribution to the Nuclear Shell Model. The quantum mechanical joint position-momentum quasi-distribution function is applied to the nuclear shell model. By introducing approximate quasi-position and quasi-momentum variables, the quasi-distribution function is converted into a non-negative (and hence nonquasi) distribution. Numerical results are presented for one-dimensional and three-dimensional potentials leading in three dimensions to a nonisotropic nonindependent distribution with a predominance

of low momenta at the nuclear surface. These results are in contrast with the usual Thomas-Fermi model and in addition provide a simple base for the discussion of direct nuclear reactions involving an average over many states of a residual nucleus for which linear momentum as opposed to angular momentum is a relevant quantity. ***George A. Baker, Jr., Ian E. McCarthy, and Charles E. Porter.*** *Physical Review*, v. 120, 2nd ser., no. 1, Oct. 1, 1960, p. 254-264.

* **Some Consequences of Neutron Resonance.** The interpretation of absorption spectra in terms of quantized transitions of the atom from one energy state to another is now generally understood. More recent, and therefore less familiar, is the discovery of an analogous interaction between a neutron, behaving as though it were a wave, and an atomic nucleus. Reviews some of the consequences, both theoretical and practical, of resonance between the nucleus and neutron waves. ***J. E. Lynn.*** *Endeavour*, v. 19, no. 76, Oct. 1960, p. 215-222.

* **Unitarity Conditions for Binary Processes Involving Particles of Arbitrary Spin.** Using the helicity description of two-particle eigenstates of total angular momentum, it is found that a concise statement can be obtained of the unitarity condition, in the two-particle approximation, for processes of type $A+B \rightarrow C+D$ involving particles of arbitrary spin. As an illustration of the use of this statement, a specific set of processes is discussed and some remarks are made about its application below the physical threshold. ***A. J. MacFarlane.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 570-574.

Photographic Tracking of Elementary Particles. Sheets of emulsion can be stacked so that the tracks of particles can be recorded in three dimensions. ***C. F. Powell.*** *Science*, v. 132, Oct. 21, 1960, p. 1134-1136.

Use of Bubble Chambers for Experiments With High Energy Gamma-Ray Beams. Visual particle detection methods have been used wtih high energy bremsstrahlung beams of low intensity. A method for obtaining a substantial increase in the gamma-ray beam intensity which can be passed through a 9-in. propane bubble chamber is described. The beam is collimated and then led through a hollow tube passing through the middle of the bubble chamber. It was found that use of a "beam tube" increases the number of events observed per picture by a factor between five and ten over the number found with no beam tube. The 300-Mev bremsstrahlung beam of the MIT synchrotron beam was used for these experiments. Advantages and limitations of the beam tube method are discussed. ***L. Guerriero, et al.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1040-1043.

* **Relative Nuclidic Masses.** Tabulates a complete and consistent list of nuclidic masses, and also a few derived quantities. ***F. Everling, L. A. König, J. H. E. Mattauch, and A. W. Wapstra.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 529-569.

Use of Silicon p-n Junction Detectors in Studies of Nuclear Reactions Induced by Heavy Ions. Experiments in which Si p-n junctions have been used as detectors of fission fragments and elastically scattered heavy ions are described. The curve of pulse height versus energy for C particles is linear and passes through the origin. Points for Cf^{252} fission fragments and alpha particles fall on the curve determined by the C-particle points. This result implies that the energy required for electron-hole pair formation is the same for the three types of particles. Also, no "ionization defect" is observed for the fission fragments. Some other possible uses for detectors of this type are suggested. ***Almon E. Larsh, Glen E. Gordon, and Torbjørn Sikkeland.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1114-1118.

The Stilbene Scintillation Crystal as a Spectrometer for Continuous Fast-Neutron Spectra. A method is described for measuring neutron spectra in the energy range 1 to 10 Mev. The pulse-height spectrum of scintillations produced in a stilbene crystal by recoil protons originating in the crystal is analyzed to yield the incident neutron energy distribution. Insensitivity to gamma rays and electrons is achieved by utilizing differences in the pulse shapes of light pulses produced by electrons and protons. This spectrometer is useful for both group and continuous spectra and has been tested by measurement of the spectra from a Pu-Be neutron source and from the spontaneous fission of Cf^{252}. Both measurements are consistent with previous

data. The Pu-Be data definitely confirm a peak at 9.7 Mev that was suggested by previous data. ***H. W. Broek and C. E. Anderson.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1063-1069.

Separated 1.17-Bev/c K^- Meson Beam. Describes the design and testing of a 1.17-Bev/c separated K^- beam designed in the fall of 1958 in connection with a 15-in. hydrogen bubble chamber experiment. At the target the K^-/π^- ratio was 1/140. At the chamber, 4.0 K^- meson decay lengths from the target, and after two stages of electromagnetic separation, the K^-/π^- ratio was 12.5, corresponding to a total pion suppression by a factor of about 10^5. The K^- flux at the chamber was 0.87 K^- mesons per 10^{10} protons impinging on the target. ***Phillippe Eberhard, Myron L. Good, and Harold K. Ticho.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1054-1063.

Injection of Fast Neutral Beams Into the Three-Stage Tandem Accelerator. An experiment is described in which a beam of fast neutral atoms was injected into the terminal of a tandem accelerator. A second tandem was arranged in line with the first. By taking advantage of charge-exchange mechanisms, these atoms were accelerated to 15 Mev by a three-stage process, ***P. H. Rose, et al.*** *Review of Scientific Instruments*, v. 31, Oct. 1960, p. 1052-1053.

* **A Simple Method for the Calculation of the Fermi Age of Light Water.** It is possible to subdivide the examined lethargy range in a suitable way, and to solve the monenergetic Boltzmann equation for each of the intervals. This procedure corresponds to a summarizing of neutrons of different energies into "groups", which is often done in the diffusion approximation. The application of this procedure to the calculation of the Fermi age of H_2O leads to a value of $\tau = 25.0$ cm^2, which is in very good agreement with the theoretical value of $\tau = 25.3$ cm^2 obtained again and again by other methods. (*In German.*) Ein einfaches Verfahren zur Berechnung des Fermi-Alters von leichtem Wasser. ***N. Papmehl.*** *Atomkernenergie*, v. 5, Oct. 1960, p. 357-360.

* **An Equivalence Theorem for Partially Gauge-Invariant Vector Meson Interactions.** ***Abdus Salam.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 681-690.

* **Hole-Hole Interactions and the Properties of Nuclear Matter.** The contribution of hole-hole interaction to the ground state energy of nuclear matter is estimated for a mutual interaction containing a repulsive core and an exponential well outside, and is found to be only about ⅝ MeV per particle. ***S. A. Moszkowski and A. M. Sessler.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 669-671.

* **A Method for Calculating Scattering Phase Shifts.** A method, based on perturbation theory, is derived for obtaining the reflection coefficient for scattering a plane wave by a potential well of a particular type. This type is an extension of a simple potential well, whose reflection coefficient is known. This method has the advantage that exact limits can be placed on the possible error due to using the perturbation expansion. A possible application is the exact determination of the effect on the cross section of a "tail" added to a potential well. ***J. N. Lyness.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 654-668.

* **Cross-Sections for $Al^{27}(p,3pn)Na^{24}$, $Al^{27}(p,5p5n)F^{18}$ and $C^{12}(p,3p3n)Be^7$ Relative to $C^{12}(p,pn)C^{11}$.** The excitation functions for the reactions $Al^{27}(p,3pn)Na^{24}$, $Al^{27}(p,5p5n)F^{18}$ and $C^{12}(p,3p3n)Be^7$, are measured relative to $C^{12}(p,pn)C^{11}$ employing internal proton beam of a 396 cm synchrocyclotron. Results ae compared with those reported from other laboratories. ***Vastupal Parikh.*** *Nuclear Physcs*, v. 18, no. 4, Sept. 1960, p. 638-645 + 1 plate.

* **Absolute Cross-Sections of $C^{12}(p,pn)C^{11}$ From 288 to 383 MeV.** The excitation function for the reaction $C^{12}(p,pn)C^{11}$ is measured in the external proton beam of a 396 cm synchrocyclotron. The C^{11} activity is measured by a calibrated γ-ray G. M. counter. The results are compared with those reported from other laboratories. ***Vastupal Parikh.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 628-637 + 1 plate.

* **Integrated Cross Sections for the Reactions $A^{40}(\gamma,p)$ and $A^{40}(\gamma np)$.** The (γ,p) and (γ,np) reactions in A^{40} have been re-examined with 34 MeV bremsstrahlung by measuring the

product chlorine radioactivities. Details of the sample preparation are given. Yields relative to $C^{12}(\gamma,n)$ and $Cu^{63}(\gamma,n)$ were determined by β counting. From additional measurements with a lead absorber in the beam, the following cross sections integrated to 33 MeV have been deduced: (100±15) MeV·mb for (γ,p) and (25±10) MeV·mb for (γ,np). This excludes definitely the anomalously high cross section values reported in the literature. An approximate yield for the $(\gamma,2p)$ process is also given. ***H. G. Dosch, K. H. Lindenberger, and P. Brix.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 615-623.

* **Energies of Alpha Particles.** Energies of α particles emitted in ground-state transitions between nuclei with mass <200 have been computed from experimental data obtained with magnetic spectrometers using the newest calibration results. ***Aaldert H. Wapstra.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 587-595.

The Elastic and Inelastic Scattering of Electrons and Positrons From the S-States of Atomic Hydrogen. Total elastic and inelastic cross sections, for the scattering of electrons (without exchange) and positrons (neglecting the formation of positronium) from the 1s, 2s and 3s states of atomic H, have been calculated in three approximations using the method of partial waves. All significant partial wave contributions to the cross sections have been included. The results indicate that "s-state" distortion effects are negligible at incident energies greater than 30 ev. ***K. Smith, W. F. Miller, and A. J. P. Mumford.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 559-564.

* **Electromagnetic Structure of the Nucleon. V. Numerical Results of Three-Pion-State Contributions.** Numerical results of the 3π-state contributions to the isoscalar part of the electromagnetic structure of the nucleon are presented in the no-loop approximation of relativistic perturbation theory. They are compared with the previous results obtained on other approximations. ***Kichiro Hiida and Noboru Nakanishi.*** *Progress of Theoretical Physics*, v. 24, no. 2, Aug. 1960, p. 414-417.

* **On a Model of Nucleon Structure and Meson-Nucleon Interaction. I.** The problems of π-nucleon collision and nucleon-antinucleon annihilation are treated using a phenomenological model in which we assume the existence of the repulsive core for nucleon-nucleon potential and the attractive core for nucleon-antinucleon potential. The results give rather good agreement with experimental evidence not only with respect to π-nucleon collision but also to nucleon-antinucleon annihilation. ***Hiroshi Nakamura.*** *Progress of Theoretical Physics*, v. 24, no. 2, Aug. 1960, p. 271-290.

* **Universality of Coupling Constants and Individual Γ_s-Invariance.** The characteristics of the interaction of elementary particles are summarized as "universality" and a sort of invariance which will be called "individual Γ-invariance". That these are the requisites of forthcoming theories is pointed out. ***Kenzo Iwata.*** *Progress of Theoretical Physics*, v. 24, no. 2, Aug. 1960, p. 308-316.

* **Information About the Proton-Proton Scattering Matrix From Coulomb Interference.** It is shown that a measurement of the p-p scattering parameters at very small angles and angles close to π where coulomb interference is important will directly determine the coefficients of the scattering matrix. Since the coefficients are known functions of the phase shifts, such measurements may rule out some of the phase shift solutions and may provide a unique set of phase shifts. ***B. P. Nigam.*** *Progress of Theoretical Physics*, v. 24, no. 2, Aug. 1960, p. 407-413.

* **Symmetries of the Interactions Among Strongly Interacting Particles and Non-Leptonic Decays of Hyperons.** A symmetry law which can hold true in both strong and weak interactions among the strongly interacting particles is investigated and an example is given. The requirement of invariance under the proposed symmetry transformation and some assumptions lead to the interactions which give consistent result with experiments of $\Sigma\pm$ and Λ decays. Implications of such a symmetry law are discussed and the problems concerning the K-meson decay into two pions are mentioned. ***Kanji Fujii.*** *Progress of Theoretical Physics*, v. 24, no. 2, Aug. 1960, p. 259-270.

Reports to the AEC Nuclear Cross Sections Advisory Group. Investigations of Argonne National Laboratory, Brookhaven National Laboratory, Columbia University, Duke University, Hanford Laboratories, Los Alamos Scientific Laboratory, and of other institutions are described. *U. S. Atomic Energy Commission, WASH*-1029, Sept. 19-21, 1960, 82 pp. (UF767 Un3.1w Contin.)

* **On the Scattering of Slow Neutrons in the Hydrogen Containing Molecules.** Results in the report can be divided into the following problems; verification of the theory of neutron scattering by molecules of molecular gases; examination of the structure of liquids by investigation of experimental deviations of the scattering cross sections from the theory; neutron scattering by polarized molecules; neutron scattering by molecules which possess a vibrational energy level in the thermal energy region. (*In German.*) Über die Streuung der Thermischen Neutronen in den Wasserstoffenthaltenden Molekülen. ***Jerzy A. Janik, et al.*** *Nukleonika*, v. 5, nos. 7-8, 1960, p. 495-500.

Annual Technical Progress Report. AEC Unclassified Programs Fiscal Year 1960. Sections of sodium reactor experiment, of engineering and development design criteria, of organic moderated reactor experiment, of Piqua research and development, of reactor safety, of separations chemistry, of advanced development program are discussed. *U. S. Atomic Energy Commission, NAA-SR*-5350, Aug. 1, 1960, Individually paged. (UF767 Un3.1na Contin.)

Proposal of the Detectivity D^{**} for Detectors Limited by Radiation Noise. A new kind of detectivity, called D^{**}, is proposed for cells that have a detectivity that is limited by radiation noise. The detectivity D^{**} takes specific account of the solid angle Ω, from which external radiation can reach the responsive element. Usually, the external radiation is produced by objects at room temperature. D^{**} is also appropriate for use with detectors that are non-Lambertian for reasons other than cooled radiation shields: for example, detectors that are immersed in a high-index medium, or detectors that are closely associated with a lens. ***R. Clark Jones.*** *Optical Society of America, Journal*, v. 50, Nov. 1960, p. 1058-1059.

* **Energy Levels of Si^{29}, Si^{30} and Si^{31} From (d,p) Reactions.** This $Si^{28}(d,p)Si^{29}$ reaction was used to locate nuclear energy levels in Si^{29} in the range of excitation energy between 3.5 and 9.1 MeV. The bombarding energy was 7.03 MeV and the MIT broadrange spectrograph was used to resolve the particle groups. Identification was based on a change of observation angle and a change of isotopic abundance in the target. A total of 65 levels of Si^{29} was found in the range covered, 54 of which have not been reported before. In addition, 16 particle groups were assigned to the reaction $Si^{29}(d,p)Si^{30}$ and seven groups to the reaction $Si^{30}(d,p)Si^{31}$. The Si^{30} levels lie in the range of excitation of 6.4 to 10.8 MeV and have not been reported before, whereas the Si^{31} levels lie between 2.3 and 5.5 MeV and two of these are new. Q-values and excitation energies are listed for all these groups. The uncertainty in Q-value for most of the levels is ± 5 keV. ***C. P. Browne and J. T. Radzyminski.*** *Nuclear Physics*, v. 19, no. 2, Oct. 1960, p. 164-172.

* **Reaction Matrix Singularities and the Energy Gap in an Infinite System of Fermions.** It is shown that the presence of a singularity in Brueckner's t-matrix for an infinite system of fermions is a sufficient (but not necessary) condition for the existence of a gap in the energy spectrum of the system. On the other hand there are singularities in Galtiskii's t-matrix if and only if the system has an energy gap. Furthermore, there are both singularities and an energy gap if the solution of a Schrödinger equation with modified kinetic energy has a positive phase shift δ at the Fermi momentum. The results are illustrated by deriving approximate expressions for the energy gap and the distances of the singularities from the Fermi surface in terms of the phase shift δ. ***V. J. Emery.*** *Nuclear Physics*, v. 19, no. 2, Oct. 1960, p. 154-163.

* **Multipole Order of the 869 keV Gamma Ray in Sm^{152}.** The angular correlation of the 869-244 keV γ-electron cascade in Sm^{152} was measured and the multipole mixture of the 869 keV transition has been deduced to be 98.8% E2, 1.2% M1. The influence of the rotation-vibration coupling on the E2 and M1 transitions from the γ-vibrational states in Sm^{152} is discussed. The value of the coupling parameter z is found to be 0.08.

Ove Nathan. *Nuclear Physics*, v. 19, no. 2, Oct. 1960, p. 148-153.

* **The Nuclear Spins of I^{126}, I^{132}, I^{133} and I^{135}.** Reports some recent results of a continuing program to determine the nuclear spins, magnetic moments and electric quadrupole moments of the radioactive halogen isotopes by the method of atomic beams. The determination of the ground-state spins of radioactive isotopes is particularly important for the interpretation of radioactive decay patterns, and the measurements of nuclear spins and moments provide experimental evidence for the formulation and evaluation of nuclear-structure theories. This work completes the measurement of the nuclear spins of the series of iodine isotopes I^{128} to I^{135} with the exception of the 52-min I^{134} isotope. The nuclear spins of I^{126}, I^{132}, I^{133}, and I^{135} are 2,4, 7/2 and 7/2, respectively. The nuclear spins of the iodine I^{128} to I^{135} are now known with the exception of the 52 min I^{134} isotope. ***Hugh L. Garvin and Edgar Lipworth.*** *Nuclear Physics*, v. 19, no. 2, Oct. 1960, p. 140-147.

The Internal Feedback of EBR-I Mark III. A mathematical model of the core and blankets is postulated and an analog of the equations is constructed. The response of the model and of the reactor to the same signal at any given operating conditions are in good agreement. The analog facilitates an analysis of the feedback producing the response. ***J. C. Carter, D. W. Sparks, and J. H. Tessier.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 326-339.

Dynamic Programming and Nuclear Reactor Systems Design. Suggests applications of dynamic programming techniques to nuclear reactor optimization problems. Four problems are considered, together with a short discussion of their relative significance to the field, and a possible functional equation approach to the solution of each is indicated. ***Nicholas Kallay.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 315-325.

Thermal Neutron Flux Depression by Absorbing Foils. The perturbation of a thermal neutron flux field by an absorbing foil is considered for the case of a foil of thickness t and of lateral dimensions $\geqslant L$, where L is the diffusion length of thermal neutrons in the medium. The integral equation for "one-velocity" transport of neutrons in the medium containing the foil is solved by a variational method in which the "eigenvalue" is closely related to the foil activation. The results are compared with the predictions of the Bothe and Skyrme theories. The Bothe and Skyrme theories are compared for the case of the finite disk-shaped foil and are shown to differ primarily in the transport correction. This difference may be important in cases where L is not very large compared with the mean free path of neutrons in the medium. On the basis of these considerations, a new analytic approximation for the activation of a finite foil is proposed. ***R. H. Ritchie and H. B. Eldridge.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 300-311.

Neutron Rethermalization Cross Section Measurements in Graphite. The thermal neutron absorption rate in "1/v" materials has been observed near a discontinuity in the temperature of a graphite moderator. A plausible group diffusion model of the space and energy distributions of the thermal neutrons has been assumed. The experimental data have been used to obtain the transfer cross sections, called rethermalization cross sections, to be used with this model. The cross sections obtained for crystalline graphite are small compared to those expected for gaseous graphite; but they increase by a factor of about seven, from $(1.9 \pm 0.05) \times 10^{-3}$ to $(14.5 \pm 2.6) \times 10^{-3}$ cm^{-1}, from the lowest temperature of 108 K to the highest temperature of 666 K. ***R. A. Bennett and R. E. Heineman.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 294-299.

Photoneutrons and the Control of a Pool Type Reactor. In a pool type reactor installation, the fission chambers or ionization chambers controlling the reactor detcet two types of neutrons, e.g., thermalized fission neutrons and photoneutrons produced around the detector in a D(γ,n) H reaction. If the photoneutrons are produced by fission product γ rays, there will be a superimposed neutron flux that may lead to unsafe operating conditions. This effect has been analytically and experimentally studied, and it is shown here that the unsafe conditions can be suppressed either by placing the detector closer to the reactor or by limiting the rate of change of reactor flux to a safe value. ***A. L. Colomb.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 289-293.

* **Comparison Between Pressurized Water and Boiling Water Reactor Systems in Nuclear Plants.** Some of the advantages of boiling water reactors were determined, such as the possibility of lowering the pressure by 30 to 40% and the need for lower wall-thickness values, which entails lesser expenses and work. From 15 to 20% material is spared. The cycle for pressure equalizing reservoir can be dispensed with. The speeds of water circulation in order to obtain satisfactory thermal transfer are half of what they must be with pressurized water reactors. (*In German.*) Vergleiche von Druckwassermit Siedewasserreaktor-Systemen in Kernkraftwerken. ***E. Praceus.*** *Energietechnik*, v. 10, no. 8, Aug. 1960, p. 341-345.

* **Automatic Control of Power Reactor Systems.** A control diagram, frequency diagrams and other sketches and formulas are cited and discussed. ***J. H. Bowen.*** *Control*, v. 3, no. 28, Oct. 1960, p. 114-118.

Steam Cycles for Power Reactors-2. A previous article outlined the improvements in steam turbine cycles leading to higher efficiencies in conventional stations. This article is a summary of the problems connected with cycle selection. ***W. J. Thomas and R. A. Lorge.*** *Nuclear Power*, v. 5, Oct. 1960, p. 88-91.

Scintillation Counters. A survey of some of the more widely applicable phosphors and photomultipliers used for scintillation counting. ***R. B. Owen.*** *Nuclear Power*, v. 5, Oct. 1960, p. 82-86.

* **Elastic Scattering of Nucleons nad Pions at Very High Energy.** Theoretical considerations concerning the elastic scattering of nucleons and pions in the GeV region are presented. Criteria for the validity of the simplest picture and a formula for constructing the optical potential from known phase shifts are given. The comparison with existing data reveals a sharp discrepancy in the case of p-p scattering at 8.5 GeV (this has been reported by Veksler in Kiev). Various possibilities to get rid of this disagreement are discussed: introduction of the real part of phase shifts (for which the dispersion relations would give a direct check), spin-dependence of nuclear interactions (which leads to predominance of singlet state interaction), and quasi-resonance. Some remarks are added on relevant topics. ***Z. Koba, A. Krzywicki, R. Raczka, and Z. Chyliński.*** *Nuclear Physics*, v. 19, no. 2, Oct. 1960, p. 199-220.

* **An Experimental Search for Dipole Structure of the Electron.** By measuring absolute cross sections for the elastic scattering of electrons from the α particle, a determination of the quantity $a(q) = [\lambda^2(q) + \mu^2(q)]^{1/2}$has been found, where $\lambda(q)$ and $\mu(q)$ are structure form factors of an electric dipole moment and an anomalous magnetic dipole moment of the electron. ***George R. Burleson and H. W. Kendall.*** *Nuclear Physics*, v. 19, no. 1, Sept. 1960, p. 68-78.

* **The W^{187} Decay Scheme and Possible Vibrational Levels in an Odd-Mass Nucleus.** The transitions and levels of Re^{187} populated by W^{187} β^- decay have been investigated with a bent crystal spectrometer, an iron-free homogeneous-field spectrometer, an iron-free 180°-focusing spectrometer and a fast-slow coincidence angular-correlation unit. There have been observed 17 transitions, which are interpreted to establish eight excited levels in Re^{187}. An analysis of the levels in terms of the Nilsson description shows that certain definite discrepancies exist between the theoretically expected level order and that observed. It is therefore suggested that two of the levels observed may correspond to the coupling of single particle states to γ vibrations. ***C. J. Gallagher, Jr., W. F. Edwards, and G. Manning.*** *Nuclear Physics*, v. 19, no. 1, Sept. 1960, p. 18-39.

Study of Irradiation Effects and the $H^2 + H^2$ Buildup in Tantalum. The irradiation effects and the increase of neutron yield from the deuterium-deuterium reaction in Ta was studied at a bombarding energy of 350 kev and a target current 100 μa. The irradiated targets were annealed at temperatures from 45 C to 770 C. A thermal analysis shows that a prominent exothermic maximum in the annealing spectrum occurs at approximately 612 C. This maximum is associated with an increase in pressure, indicating an abrupt increase in diffusion of deuterium from the target at this temperature. From a study of diffusion of deuterium from the specimen at three temperatures, an activation energy of 0.24 ev is calculated for diffusion of deuterium in Ta. ***A. F. Gabrysh, H. Eyring, M. E. Wadsworth, G. S. Baker, and T. Ree.*** *Journal of Applied Physics*, v. 31, Oct. 1960, p. 1785-1791.

* **Improvements in the Fast Neutron Time of Flight Technique Using Pulse Shape Discrimination in an Organic Phosphor.** A very simple pulse shape discriminator based upon the method suggested by Owen has been developed for the scintillation detector of a neutron time of flight apparatus. Almost complete cancellation of γ-ray pulses is obtained with the circuit adjusted to pass neutrons of energies greater than 0.4 MeV. By discriminating against γ-rays with the detector placed inside a large water shield, the random background has been reduced by a large factor. The improvement obtained is illustrated with an inelastic neutron spectrum taken with iron at 4 MeV incident neutron energy. In this case the background reduction factor is between 5 and 10. ***R. Batchelor, W. B. Gilboy, A. D. Purnell, and J. H. Towle.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 146-150.

* **Basic Concepts of Nuclear Energy.** A study of nuclear physics covering the physics of nuclear reactor, the heat transfer from the nuclear reactor, a description of the main types of reactor, the problems of protection against radiation and of safety, the stage of the research on fusion, the situation of nuclear energy in Europe and Austria. (*In German.*) Grundbegriffe der Kernenergie. ***H. Grümm.*** *Elektrotechnik und Maschinenbau*, v. 77, no. 19, Oct. 1960, p. 421-465.

* **High Density Operation—Aim at Big Rock Point.** Construction of Consumers Power Company's Big Rock Point nuclear power station was started early this year. The specific objective of this plant is to develop and test a nuclear core that will be less expensive and have increased power density and longer operating life than is possible with present designs. The general features and philosophy underlying the design of this plant are described. *Power Engineering*, v. 64, Oct. 1960, p. 46-48.

* **On the Separation of π^+ Mesons by a Time of Flight Method.** A time analyzing coincidence unit of short resolving time has been employed to separate photoproduced π^+ mesons from electrons and protons by a time of flight method. The positive pions are additionally identified by their decay characteristics, so that an assessment of the method as a mass discriminator can be made. ***G. M. Lewis, E. Gabathuler, and R. E. Azuma.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 230-232.

* **Calculated Shapes for Neutron Bursts Produced by Phased Chopper Velocity Selectors.** The burst shapes and transmission probabilities for neutrons passing through a phased chopper neutron velocity selector of the type now being used at the Materials Testing Reactor have been calculated using an IBM-650 computer. Choppers with three types of slits (straight, parabolic, and circular) are considered and burst shapes are presented that show the operating characteristics of such velocity selectors. A function that gives a good fit to many of the burst shapes is presented. The results verify that a circular slit chopper can be used in place of the more exact parabolic slit chopper with only minor distortions in the operating ranges of interest. ***Norman H. Tolk and Robert M. Brugger.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 203-210.

* **Tandem Electrostatic Accelerators.** In this type of accelerator a constant potential is applied to the acceleration of the ion beam, however, not as conventionally with just one voltage application, but instead with a number of applications made in succession by means of a tandem arrangement of high voltage tubes. This number of voltage applications, which is the number of the so-called "stages" of a tandem accelerator, may be two, three, or four, depending on the design chosen. The principles of this type of accelerator are described, and a brief account is given of the design and performance tests of a two-stage accelerator for an output rating of 10 MeV and one-half microampere of protons. Some possibilities for future development are discussed for reaching greater energies by means of three and four-stage tandem arrangements. Preliminary experimental results show the feasibility of operating these by means of the injection of a beam of neutral particles, thus retaining the use of an external ion source at ground potential, as in the present two-stage tandem accelerators. ***R. J. Van de Graaff.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 195-202.

* **On the Efficiency of the Reaction $H^3(d,n)He^4$ in Titanium Tritide Bombarded With Deuterons.** The lack of accurate energy loss data in metals (and particularly in titanium tritide) of deuterons of less than 100 keV has been shown to cause large uncertainties in calculations of the neutron yield produced by the $H^3(d,n)He^4$ reaction when a titanium tritide target is bombarded with low energy deuterons. Direct measurements of the energy loss in titanium hydride foils of 40-150 keV deuterons have been made, and have been used in combination with data in the literature for other metals and higher ion energies to recalculate the neutron yield from this $H^3(d,n)He^4$ reaction in titanium tritide for the deuteron energy range 9-150 keV. Using this yield curve, a technique has been described for estimating how tritium concentration varies with depth in the titanium tritide material by examining the observed variation of neutron yield with incident angle and energy of the bombarding deuteron beam. It has been found that the concentration peak is never less than 300 Å below the surface, and that there is very little tritium contained in an upper surface layer of about 500 Å, or in the lower one-third of the titanium tritide material. ***E. M. Gunnersen and G. James.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 173-184.

Temperature Control of Fueled Irradiation Capsules by Variable Conductance. An irradiation capsule for high-temperature fuel irradiations was developed to permit constant temperature control over a range of about $\pm$ 35% of design power. Control is achieved by the variation in thermal conductivity of a binary gas mixture in a control annulus located between the test specimen and the capsule coolant. In-pile operation of capsules using this method of control has demonstrated that the desired temperature may be controlled to within $\pm$ 25 F automatically, and probably more closely if manually controlled. The automatic control system also protects the capsule from temperature overshoot during a fast reactor recovery following a scram. ***W. W. Godsin.*** *Nuclear Science and Engineering*, v. 8, Oct. 1960, p. 340-345.

* **Angular Distribution of Fission Fragments Produced by Low Energy Neutrons.** The angular distribution of fission fragments produced in the capture of low orbital momentum particles is considered. The spin of the target nucleus is taken into account. The effect of fluctuations of the transition nucleus levels distribution on the angular distribution of the fission fragments is also considered. (*In Russian.*) Uglovoe raspredelenie oskolkov deleniia, vyzvannogo neĭtronami maloĭ energii. ***V. M. Strutinskiĭ.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 39, no. 3(9), Sept. 1960, p. 781-793.

* **Collisions of Particles in a High Temperature Plasma.** A kinetic equation is derived for a high-temperature plasma. The effective cross sections for collisions between electrons and electron-ion collisions are computed without artificially cutting off the interaction. The role of plasma oscillations in the plasma kinetics is elucidated. It is shown that the effect of the ions on screening of the interaction should be taken into account during electron-ion collisions. (*In Russian.*) Stolknoveniia chastits v vysokotemperaturnoĭ plazme. ***O. V. Konstantinov and V. I. Perel'.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 39, no. 3(9), Sept. 1960, p. 861-871.

* **Investigation of Secondary Capture of Lithium Nuclei by Lead.** The formation of astatine isotopes in lead under bombardment by 80-660 MeV protons, 75-370 MeV deuterons and 210-810 MeV α particles has been studied by a radiochemical method. The astatine isotopes are obtained as a result of secondary capture of over Coulomb Li nuclei produced in fragmentations. The At^{211} yield under α particle bombardment reaches 0.3 microbarn and is practically independent of the α particle energy. (*In Russian.*) Izuchenie vtorichnoĭ reaktsii zakhvata iader litiia svintsom. ***Van Iun-iuĭ, V. V. Kuznetsov, M. Ia. Kuznetsova, V. N. Mekhedov ,and V. A. Khalkin.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 39, no. 3(9), Sept. 1960, p. 527-535.

* **A New Branch of Spectroscopy - Nuclear and Electron Resonance Measurement.** The method depends on the measurement of the energy absorption of precessing nuclei or electrons. Proton resonance has found the widest application in the elucidation of structure and also in analytical chemistry, operational control and biochemistry. (*In German.*) Elektronenresonanz, Kernresonanz - ein Neuer Zweig der Spektrometrie. ***H. Wirth.*** *Atomwirtschaft*, v. 5, no. 10, Oct. 1960, p. 461-462.

* **Asymptotic Behavior of Cross Sections at High Energies.** The transformation of two particles into three or four particles

at high energies is treated in the pole approximation. In the energy region in which the total elastic scattering cross section is independent of energy, the cross section for transformation of two particles into three does not decrease with increasing energy. The cross section for transformation of two particles into four grows logarithmically with the energy. (*In Russian.*) Ob asimptoticheskoĭ zavisimosti sechenīĭ pri bol'shikh energiiakh. ***V. B. Berestetsky and I. Ya. Pomeranchuk.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 39, no. 4(10), Oct. 1960, p. 1078-1086.

* **Fast Photoneutrons From Some Elements.** The angular distributions of photoneutrons possessing energies > 10 MeV produced by irradiating Li and I with 90 MeV peak energy bremsstrahlung were investigated. The distribution was found to be highly asymmetric with respect to the angle 90°, most of the neutrons being emitted at small angles. The energy distributions of neutrons and protons measured with the same apparatus were compared. The yields of fast photoneutrons from some elements were measured. (*In Russian.*) Bystrye fotoneĭtrony iz nekotorykh elementov. ***L. A. Kulchitsky and V. Presperin.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 39, no. 4(10), Oct. 1960, p. 1000-1004.

* **Effectiveness of a System of Rod Absorbers in a Reactor Fitted With a Reflector.** In a two-group approximation, criticality conditions and neutron flux distributions were obtained in a homogeneous reactor for hot neutrons with a rod absorber system. (*In Russian.*) Effektivnost' sistemy pogloshchaiushchikh sterzhneĭ v reaktore s otrazhatelem. ***V. I. Nosov.*** *Atomnaia Energiia*, v. 9, no. 4, Oct. 1960, p. 262-269.

* **Angular Distributions and Polarization in Stripping Processes and in Direct Reactions.** General expressions are found for angular distributions and polarization effects in a variety of direct reactions. These reactions include processes involving the stripping of deuterons and of heavier nuclei, in addition to inelastic-scattering phenomena which arise either from individual nucleon-nucleon encounters or from collective effects at the nuclear surface. Various selection rules are found for the existence of polarization, using the distorted-wave Born approximation and allowing for spin-dependent distortions. The influence of a neighboring isolated resonance state of the compound nucleus is examined, and modifications are found of the general results. Expressions are given for the angular correlation of the γ rays following de-excitation of the residual nucleus. ***L. J. B. Goldfarb and R. C. Johnson.*** *Nuclear Physics*, v. 18, no. 3, Sept. 1960, p. 353-394.

* **Pion-Pion Effects in τ-Decay.** The effects of pion-pion interactions in resonant form in the s-states of isobaric spins 0 and 2 are studied in some details with respect to the energy and angular distributions of the unlike pion in τ-decay. The relation of the resonance picture with that of the more conventional effective range theory of pion-pion interaction is clarified. It is found that the pion-pion hypothesis is capable of explaining the observed distribution in a variety of ways, depending on the choice of the resonance parameters. ***A. N. Mitra.*** *Nuclear Physics*, v. 18, no. 3, Sept. 1960, p. 502-515.

* **Precision Measurements of Energies of Gamma-Rays Following the Decay of Some Gold Isotopes.** The energies of eight gamma-rays occurring in the decay of some gold isotopes have been determined from their conversion-line momenta as measured with an Fe-free double-focusing spectrometer. The Bρ-assignments to the lines following the decay of ^{194}Au, ^{196}Au, ^{196}Au (10 h) isomer and ^{198}Au are obtained by using the conversion lines of the 158 keV transition in ^{198}Hg as calibration line. Absolute Bρ-values of the latter lines could be determined applying the self-consistent method of Siegbahn. Disregarding the calibration uncertainty (about one part in 10^4) the accuracy reached in the energies of the gamma-rays is about 7 parts in 10^5. Our value 411.766 $\pm$ 0.028 keV for the energy of the well known E2 transition in ^{198}Hg is in nice agreement with other values, some of which have been determined directly with a curved crystal. ***C. De Vries and J. H. Dijkstra.*** *Nuclear Physics*, v. 18, no. 3, Sept. 1960, p. 446-453.

* **Proceedings of the Second Conference on Nuclear Radiation Effects on Semiconductor Devices, Materials and Circuits.** Conference held September 17 and 18, 1959. A brief resumé of radiation effects on semiconductor materials, high-energy electron irradiation of Ge and Si, the nature of non-equilibrium excess conductance induced in Si by nucleon irradiation, transient radiation effects in semiconductors, positive ion bombardment of metals with radioactive Kr.-85, and other problems are discussed. ***Samuel L. Marshall and Oscar Fisch, editors.*** 128 pp. 1960. Cowan Publishing Corp., New York. (QC612.S4 C77p Over.)

Search for $S = -2$ Negative Heavy Meson in Nuclear Emulsions. A search for the D^- meson was conducted in an emulsion stack exposed to the 300-Mev/c K^- beam at Berkeley. The stars initiated by the beam particles were investigated for possible emission of two strangeness-carrying particles, and in addition, mass measurements were done on the short-range tracks. In about 10,000 events examined, no possible $S = -2$ particle has been observed. ***Y. Eisenberg, M. Friedmann, G. Alexander, and D. Kessler.*** *Physical Review*, v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 1021-1022.

* **The Selective Excitation of Molecular Emission by the Metastable Atoms of Rare Gases.** A quantitative study is made of the intensity of the emission spectra of CO and N_2 diluted in rare gases. A selective excitation is obtained in the systems of the CO molecule and the N_2 molecule. Selective vibrational levels of the upper electronic states are strongly enhanced. They correspond to the resonance excitation by collision of the metastable X (^{3}P) atoms with the normal CO and N_2 molecules. (*In French.*) Excitation sélective d'émissions moléculaires par les atomes métastables de gaz rares. ***L. Herman and D. Rakotoarijimy.*** *Journal de Physique et le Radium*, v. 21, nos. 8-9, Aug.-Sept. 1960, p. 629-633.

* **Small-Angle X-Ray Scattering by Pile-Irradiated Graphite.** Argues that neutron diffraction shows that point defects occur in irradiated graphite in sufficient concentration to cause true small-angle X-ray scattering, provided they cluster in a manner similar to that postulated. ***W. T. Eeles.*** *Nature*, v. 188, Oct. 22, 1960, p. 287-289.

Approximate Calculation of Nuclear Binding Energy. The binding energy, size, and shape of finite nuclei are studied, using a method which tests the "local uniformity" assumption. This assumption implies that the properties of finite nuclei can be obtained from those of infinite nuclear matter. The energy is computed, using as a trial wave function an amplitude- and frequency-modulated plane wave; this permits the use of nuclear-matter results in a straightforward manner. ***Leonard S. Rodberg and Vigdor L. Teplitz.*** *Physical Review*, v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 969-976.

Papers From Seventh Semiannual Shielding Information Meeting, October 14-15, 1959. Recent fission γ-ray spectral measurements, effective neutron removal cross section of Zr, determination of neutron and secondary photon spectra from a thick laminated shield with spherical symmetry, γ penetration by transmission matrix method, γ-ray penetration into the compartments of a light aircraft carrier, and other problems are discussed. *U. S. Atomic Energy Commisison, XDC* 60-6-70, individually paged. (UF767 Un3.1x Contin.)

* **The Instrumentation for a High-Temperature Reactor.** A detailed description is given of the measuring probes in the radioactive cooling gas system. The most interesting are the transducers for the cooling-gas and blocking-gas pressure, those for the temperatures in the reactor installation, and those for the impurities in the cooling gas. The constructional requirements from the point of view of safety, the required accuracy, measuring range and the selection of measuring points, are explained. (*In German.*) Die Instrumentierung eines Hochtemperaturreaktors. ***Walter Strümer, Eberhard Elssner, and Fritz Helfrich.*** *ETZ: Elektrotechnische Zeitschrift*, v. 12, Ausgabe B, no. 21, Oct. 1960, p. 508-515.

* **Structure Research With the Aid of Neutron Diffraction.** The significance of neutron diffraction in research on physical properties of solids is discussed. The theoretical basis of the exchange reaction of neutrons with material and the resulting possibilities for the application of neutron scattering in determination of crystal and magnetic structures are compared with X-ray scattering. A neutron diffraction spectrometer, and some results, are communicated. (*In German.*) Strukturforschung mit Hilfe von Neutronenbeugung. ***Siegfried Balke and Gernot Lutz.*** *Chemie-Ingenieur-Technik*, v. 32, Oct. 1960, p. 651-658.

Construction and Operation of the Research Reactor DR 1. The smallest of the reactors at the research establishment at Risŏ, it is a homogeneous solution-type reactor fabricated by Atomics International. DR 1 attained its criticality on August 15, 1957. Describes the reactor components as well as the reactor building. ***P. Frederiksen.*** *Danish Atomic Energy Commission, Risŏ Report No.* 10, Sept. 1959, 36 pp. (QC770 D39.1r Contin.)

* **The Oscilloscope Method of Measuring Nuclear Half-Lives.** It is shown that the modern fast oscilloscopes, now available commercially, are very simple and powerful tools for measuring nuclear half-lives. The advantages and the limitations of the method are discussed. In order to illustrate the problems which are associated with measurements in different half-life regions, seven half-life associated with metastable states in the following nuclei were measured: Pb^{205}(4.1ms), Pb^{206}(125 μs), Ta^{181}(17.5 μs), Rb^{85}(1.0 μs), Pb^{204}(302 mμs), Pb^{203}(55 mμs), and Ta^{181}(11.0 mμs). ***I. Bergström, E. C. O. Bonacalza, A. Jech, M. Perez, and P. Thieberger.*** *Nuclear Instruments and Methods*, v. 8, Aug. 1960, p. 151-172.

International Conference on High-Energy Accelerators and Instrumentation—CERN 1959. Proceedings. ***L. Kowarski, editor.*** 705 pp. 1959. CERN European Organization for Nuclear Research, Geneva. (QC786 In8p)

OPERATIONS RESEARCH

Are We Falling Behind in Mechanization? Many of the most advanced production systems, the most progressive machinery and equipment ideas, seem to be coming from abroad. ***James R. Bright.*** *Harvard Business Review*, v. 38, no. 6, Nov.-Dec. 1960, p. 93-106.

Simulation—Tool for Better Distribution. ***Harvey N. Shycon and Richard B. Maffei.*** *Harvard Business Review*, v. 38, no. 6, Nov.-Dec. 1960, p. 65-75.

* **The Ethical Challenge of Modern Administration.** By the development of his administrative skills, man preserves and extends his freedom. The complexity of modern society and the omnipresence of large-scale organizations not only provide an opportunity for the fullest development of the responsible self, they actually place a premium on the exercise of a greater measure of personal responsibility by more people than ever before. ***Ordway Tead.*** *Advanced Management*, v. 25, Oct. 1960, p. 8-12.

* **Summary of a Heuristic Line Balancing Procedure.** Presents an heuristic procedure for balancing production assembly lines and a computer program for carrying out that procedure. ***Fred M. Tonge.*** *Management Science*, v. 7, no. 1, Oct. 1960, p. 21-39 + 3 appendixes.

* **An Exercise in Operations Research. RCAF Aircraft Maintenance.** More exact expressions for aircraft group response to use and change are derived. Three assumptions are made: aircraft of the same production identity are subject to a consistent pattern of failure in use, provided their environments, and the techniques of handling applied to them are the same; handling techniques are subject to a similar pattern of consistency where operators receive the same training, and employ that training to the same ends; and the effect of environment upon failure patterns can be isolated and evaluated if the two previous assumptions are correct. ***A. B. Howell.*** *Engineering Journal*, v. 43, Nov. 1960, p. 72-80.

Purchasing: The Case for Written Policies. A recent survey shows that only one company in four today has written purchasing policies. This article tells why—and how—they should be developed. ***Samuel C. Farmer.*** *Management Review*, v. 49, Nov. 1960, p. 29 + 8 pages.

Management by Machine. How Much and How Soon? During the next 25 years, the job of the manager will undergo some major changes, as machines take over more and more of the activities that now seem too complex and "high-level" ever to yield to automation. The chances are strong that, even before this decade is over, machines will be able to perform any

function in the organization—and this includes the "thinking" and "deciding" tasks that are the basis of the manager's job. ***Herbert A. Simon.*** *Management Review*, v. 49, Nov. 1960, p. 12 + 20 pages.

The Care and Grooming of the Corporate Image. The decade of the sixties promises to be one in which the corporate image—much discussed and argued over in the fifties—finally comes of age. ***J. Gordon Lippincott and Walter R. Margulies.*** *Management Review*, v. 49, Nov. 1960, p. 4-11.

* **Queuing Systems in Which the Discipline Is "Last-Come, First-Served".** Compares the waiting-time distributions under different queue disciplines of customers in a single-server queuing system with Poisson input and general (independent) service time. To make the comparison it is necessary to know the distribution of the unexpended service time at a moment of arrival, and the distribution of busy periods. These are discussed and it is shown that the variance of the waiting-time distribution when the queue discipline is "last-come, first-served" is greater (whatever the service-time distribution) than the corresponding variance when the queue discipline is "first-come, first-served". The same comparison is also discussed (and is shown to be simpler) for the system with general independent input and negative exponential distribution of service times. ***David M. G. Wishart.*** *Operations Research*, v. 8, no. 5, Sept.-Oct. 1960, p. 591-599.

* **Simulation of Air Operations With the Air-Battle Model.** Discusses the Air-Battle Model that, with its supporting computer programs, is a device for simulating a large-scale two-sided global war on a high-speed digital computer. The three parts, the Plan Converter, the Air-Battle Model, and the Output Programs, of the Air-Battle Model System are discussed. Some applications of the Air-Battle Model are shown and the technique of using gross summary measures to obtain a feel for some key conclusions and using detailed studies to determine why some conclusions resulted is demonstrated. ***R. H. Adams and J. L. Jenkins.*** *Operations Research*, v. 8, no. 5, Sept.-Oct. 1960, p. 600-615.

* **The Optimum Solution in Operations Research.** The concept of an "optimum" solution is defined in terms of the objective of an operations-research effort. An operational technological and investment objective is discussed and three separate formulations for a typical problem in the petroleum industry are developed in accordance with each approach. ***J. C. Ornea and Paul Stillson.*** *Operations Research*, v. 8, no. 5, Sept.-Oct. 1960, p. 616-629.

Ends and Means of Modern Management. Guides for Top Management Planning and Action. AMA Management Report No. 30. Reports the experiences and opinions of leading business executives in the areas of skilled leadership and the maintenance of favorable environments for corporate growth. ***Albert Newgarden and Eugene R. Bailey, editors.*** 158 pp. 1959. American Management Association, Inc., New York. (HD31 Am35.3e)

* **A Simple Queue With Several Preemptive Priority Classes.** Customers of a single server negative exponential queue are divided into R preemptive priority classes. The difference equations for the steady state probabilities are solved by the method of generating functions. The similarity between these and the equations for the Laplace transforms of the temporal probabilities is noted. This enables the Laplace transform of the temporal generating function to be derived in a simple way from the steady state solution. Inverse transformations are carried out in a few particular cases. Explicit results are given only for the special case when all service rates are equal. The general case requires only additional calculation, the method being the same. ***C. R. Heathcote.*** *Operations Research*, v. 8, no. 5, Sept.-Oct. 1960, p. 630-638.

* **Minimization of a Piecewise Quadratic Function Arising in Production Scheduling.** In the study of production scheduling to meet random fluctuations in supply and demand, a probabilistic measure of effectiveness can be used. This measure is a piecewise quadratic positive definite function having discontinuous derivatives at a finite number of points. The unique minimum of this function, which always exists, can be found by applying an algorithm resembling the simplex algorithm. The computations per iteration are longer and logic more com-

plicated than for the simplex algorithm. The method can be applied to any overdetermined system in which all of the critical variables are functions of a single adjustable variable. The system is assumed to be linear and the input disturbances are presumed Gaussian. ***Douglass J. Wilde and Andreas Acrivos.*** *Operations Research*, v. 8, no. 5, Sept.-Oct. 1960, p. 652-674.

* **The Systems Approach—New Key to Better Mill Profits.** This new kind of planning will fit production, inventory, and marketing into one big integrated pattern. It will help a mill to stay flexible—and profitable. ***Walter F. Friedman.*** *Textile World*, v. 110, no. 11, Nov. 1960, p. 45-49.

Seats for People. The size of the occupant, the cushion configuration, the back, shoulder and neck support, the seat-back slope, angle of hips and knees, position variation, and other problems are discussed. ***Henry Dreyfuss.*** *Machine Design*, v. 32, Nov. 10, 1960, p. 152-157.

Management Neglect Can Ruin a Good Job Evaluation Program. ***J. A. Patton.*** *Iron Age*, v. 186, no. 24, Dec. 15, 1960, p. 75-77.

* **Statistical Program Planning for Process Development.** Sequential fractional factorials can be used successfully to provide useful answers to a problem without requiring large experimental programs. ***Jesse M. Carr, Jr. and E. A. McCracken.*** *Chemical Engineering Progress*, v. 56, Nov. 1960, p. 56-61.

ORE AND MATERIALS BENEFICIATION

* **Iron Making by the Dwight-Lloyd McWane Process.** Blast furnace material requirements partly inflexible; development of the process; proven metallurgical apparatus used in process. ***Robert C. McDowell.*** *Mining Congress Journal*, v. 46, Oct. 1960, p. 58-63.

* **Basic Incorporated Increases Magnesite Production at Gabbs, Nevada.** Low grade magnesite ore with high lime and silica content is now concentrated by flotation. *Mining World*, v. 22, no. 12, Nov. 1960, p. 30-32.

Beneficiation of Iron Ore by Conductivity Separation. Dry ore beneficiation of nonmagnetic ores using the high-tension process promises low-cost operation coupled with simplicity and small space requirements. ***M. B. Mairs.*** *Iron and Steel Engineer*, v. 37, Oct. 1960, p. 167-169.

* **Magnetic Properties of Sinter From Mixes With Different Carbon Contents.** Magnetization, approximately proportional to the Fe_3O_4 content in the sinter, depends on the fuel consumption for the process and differs over the radius and height of the experimental cake. Maximum magnetization of sinter is obtained when the mix for sintering contains 5% C, which corresponds also to the most favorable technological process conditions. ***Z. I. Nekrasov, N. A. Gladkov, and V. V. Chekin.*** *Stal' in English*, 1960, no. 6, June, p. 390-393.

* **Increasing the Sintering Area of a Sintering Machine.** The development of a new design of pallet, for a type K-2-50 sintering machine, with curved sides made it possible to increase the sintering area of the machine and its productivity with comparatively small capital expenditure. ***A. V. Drimbo and D. P. Pritykin.*** *Stal' in English*, 1960, no. 6, June, p. 385-387.

* **A New Method of Lanthanum Isolation From a Mixture of Rare Earth Elements.** Deals with a new method of preparing pure La_2O_3 from a Ce-free mixture of oxides of rare-earth elements. The method is based on the utilization of the high basicity of lanthanum oxide and the reversibility of the reaction, and consists in leaching oxides of rare-earth elements with NH_4NO_3 solution. (*In Polish.*) Nowa metoda wydzielania lantanu z mieszaniny pierwiastków ziem rzadkich. ***Włodzimierz Hubicki, Kazimierz Wiącek, and Janina Wysocka.*** *Przemysł Chemiczny*, v. 39, no. 8, Aug. 1960, p. 507-509.

Hydrogen Precipitation of Nickel From Buffered Acid Solutions. A study of the H reduction of Ni ions in acetate-buffered solutions, using a Ni catalyst. At temperatures between 130 and 160 C, the rate is found to be proportional to the catalyst area, the Ni ion concentration, and the H pressure. The effect of H ions is to reduce the observed rate, likely by causing the reverse reaction (dissolution) to proceed. ***S. C. Sircar and D. R. Wiles.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 5, Oct. 1960, p. 891-893.

Barium Fluozirconate Precipitation From Hydrofluoric Acid-Zirconium Fuel Reprocessing Solutions. I. Process Chemistry. Describes scoping studies made to determine the feasibility of a barium fluozirconate precipitation as a head-end or tail-end treatment for high hydrofluoric acid-zirconium fuel reprocessing. The precipitation conditions, the degree of Zr removal, and the U loss were established. ***B. E. Paige.*** *U. S. Atomic Energy Commission, IDO*-14511, Sept. 20, 1960, 37 pp. (UF767 Un3.1id Contin.)

* **Use of Preheated and Oxygen Enriched Air When Sintering Iron Ores.** Preheating the air, drawn through the sintering bed, permits reduced fuel consumption and improves the strength of the sinter. Enrichment of this air by O increases the output of sintering machines. (*In Russian.*) Primenenie nagretogo i obogashchennogo kislorodom vozdukh pri spekanii zheleznykh rud. ***N. E. Sidorov, V. K. Antonov, N. M. Mishchenko, and F. F. Pilipaĭtis.*** *Stal'*, v. 20, no. 10, Oct. 1960, p. 878-883.

* **Coagulation of Coal Tailings by High-Molecular Polymers.** Use of polyacrylamide for the precipitating of flotation tailings showed that it increases the velocity of precipitaton and filtration of solid particles, and reduces moisture in the cake. Vacuum filters are not of much worth for filtering condensed tailings. Better apparatus, as for example a filter press, have to be installed. (*In Russian.*) Opyt koaguliatsii ugol'nykh shlamov vysokomolekuliarnymu polimerami. ***M. G. El'iashevich and M. E. Ofengenden.*** *Koks i Khimiia*, 1960, no. 10, p. 18-20.

* **Gas Chromatography Solves an Age-Old Problem in Analyzing Flotation Collectors.** Introduces gas liquid chromatography as an effective tool for determining the amount and the chemical composition of fatty acids, amines, and hydrocarbon present in flotation liquors. ***S. C. Sun and P. Argyle.*** *Mineral Industries*, v. 30, no. 1, Oct. 1960, p. 1 + 4 pages.

* **Solubility of Germanium During Lixiviation of Metallurgical Flue Dust.** Plant observations; possible causes of differential solubility; crystalline and glassy solidification; experiments carried out with synthetic mixtures of ZnO-GeO_2 and PbO-GeO_2 and with original flue dust; significance of results for metal volatilization processes. (*In German.*) Die Germaniumlöslichkeit beim Laugen von Hüttenflugstäuben. ***Siegfried Richter.*** *Neue Hütte*, v. 5, Sept. 1960, p. 525-535.

* **Possibilities of Raising Vanadium Yield During Wet Process for Vanadium Works.** Deals with the possibilities of increasing the V yield by means of neutral lying of roasted slags with following basic or acid lying. The acid process is more effective even if the yield increase is at the expense of partial contamination of the final product. It is advantageous to precipitate V by means of hydrochloric acid from solutions containing 25 g/l V and up to 15 g/l NaCl so that the excess acid in waste mother solution was 1,2 to 1,4 g/l. (*In Czech.*) Možnosti zvyšování vytěžku vanadu v mokrém provozu vanadovny. ***Drahomir Trojka.*** *Hutnické Listy*, v. 15, no. 10, Oct. 1960, p. 781-791.

* **Study of the Wet Treatment of Silesian Oxidized Zinc Ores.** Results of leaching tests on different samples of these ores by an ammoniacal solution of ammonium bicarbonate are given. Zinc in the form of insoluble oxide was found to be present in the samples studied. This zinc is incorporated in isomorphous form in the dolomitic gangue and cannot be extracted by ammoniacal leaching. (*In French.*) Étude du traitement par voie humide des minerais de zinc oxydés de silésie. ***W. Wazewska-Riesenkampf.*** *Revue de Métallurgie*, v. 57E, Oct. 1960, p. 935-945.

*** The Use of Tar Oils in Coal Flotation.** On the basis of laboratory tests, a study was performed of the possibility of using phenol-free bituminous coal and lignite tar oils as additions during the flotation of coal muds and smoke dust. The effect of the acid constituents (phenols) and organic bases of these tar oils on the degree of efficiency of flotation were examined. (*In Czech.*) Použití bezfenolových dehtových olejů v uhelné flotaci. ***J. Kmošták.*** *Paliva*, v. 40, no. 9, Sept. 1960, p. 268-272.

*** Selective Flotation of Pb-Zn Ores With Special Regard to the Flotation of Cerussite.** Owing to the presence of limestone and dolomite, which exist as gangue, only flotation with xanthate or a similar collector, after a previous sulphidization can be considered. The flotation of cerussite is affected by other factors. (*In Croatian.*) Selektivno flotiranje rude Pb–Zn s posebnim ozirom na flotiranje ceruzita. ***Franc Gregorač.*** *Rudarsko-Metalurški Zbornik*, 1960, no. 3, p. 217-225.

*** A New Inhibitor for Bornite and Chalcosine in the Selection of Copper-Zinc and Copper-Lead Concentrates.** Over 30 different organic compounds containing hydrophilic groups were investigated; congo red was the strongest among them. At the concentration determined, this reagent is capable of depressing the flotation of all the sulfides tested: galenite, chalcopyrite, bornite, chalcosine and zinc blende. (*In Russian.*) Novyĭ podavitel' dlia bornita i khal'kozina pri selektsii kollektivnykh medno-tsinkovykh i medno-svintsovykh kontsentratov. ***V. A. Glembotskii and M. M. Sorokin.*** *Akademiia Nauk SSSR, Doklady*, v. 134, no. 5, Oct. 1960, p. 1146-1149.

PHYSICS

*** New Methods of Generating Electric Power. Materials for Thermionic Generators.** Four new methods of generating electric power have been developed by Westinghouse Electric Corporation. They are the fuel cell, the thermoelectric generator, the thermionic generator, and the magnetohydrodynamic generator. Article explains the preliminary stages of the work. ***John Coltman.*** *Mechanical World and Engineering Record*, v. 140, Oct. 1960, p. 436-438.

Kinetic Theory of the Moderately Dense Rigid-Sphere Fluid. IV. Fluxes of Matter, Momentum, and Energy in a Mixture. V. Relaxation in Momentum Space. ***Robert A. Harris and Stuart A. Rice.*** *Journal of Chemical Physics*, v. 33, Oct. 1960, p. 1047-1058.

*** Quantum Theory of Uniaxial Anisotropic Ferromagnetic Crystals.** The anisotropy of the magnetic properties of ferromagnetic crystals is treated as the result of anisotropy of the interactions between the electrons of the not-filled subshells. For the calculation of the magnetization as the function of the temperature and external magnetic field two-time advanced and retarded Green Functions have been used, according to the method given in the papers referenced. The results obtained are valid for all temperatures and external magnetic fields. (*In Russian.*) Kvantovaia teoriia odnoosno-anizotropnykh ferromagnetikov. ***S. V. Tiablikov and T. Shiklosh.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 12, no. 1, 1960, p. 35-46.

*** The Thermodynamic Description of Heterogeneous Dissipative Systems by Variational Methods. I. A Formulation of the Principle of Minimum Rate of Entropy Production With Application to Certain Stationary Heterogeneous Convective Systems. II. A Variational Principle Applicable to Non-Stationary (Unconstrained) Heterogeneous Dissipative Systems.** ***J. S. Kirkaldy.*** *Canadian Journal of Physics*, v. 38, Oct. 1960, p. 1343-1365.

*** On the Study of Diffusion Using Spin Echoes.** The decay of the primary spin echo due to diffusion is governed by the expression exp $[-2/3\ \gamma^2 G^2 D_{\tau_1} \tau^3]$. This statement is independent of the angles through which the magnetization is rotated by the radio frequency (r-f.) pulses. For the usual range of experimental values, it is also independent of the intensity or homogeneity of the r-f. field, the duration of the r-f. pulse, and the magnitude of the constant field gradient. ***B. Muller and M. Bloom.*** *Canadian Journal of Physics*, v. 38, Oct. 1960, p. 1318-1327.

*** An Electromagnetic Diffraction Problem Involving Unidirectionally Conducting Surfaces.** The exact value of the electromagnetic field scattered by a unidirectionally conducting surface under plane wave excitation is obtained. The surface, which is an entire plane, is the junction of two unidirectionally conducting half-planes whose conductivity directions are inclined at an arbitrary angle to each other, and to the boundary line. ***R. A. Hurd.*** *Canadian Journal of Physics*, v. 38, Oct. 1960, p. 1229-1244.

Conditions for Specificity of Infrared Band Intensities in Polyatomic Molecules. The conditions for specificity of the intensities of infrared absorption bands corresponding to the normal vibrations of polyatomic molecules have been theoretically considered. As a quantitative criterion of the specificity of the intensity of a vibration, the coefficient of nonspecificity of intensity, γ, has been introduced. The applicability of the conditions formulated for the specificity of the integrated intensities of infrared bands is illustrated by a complete series of examples. ***L. M. Sverdlov.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 21-24.

New Recursion Formulas in the Theory of Multilayer Optical Coatings. New recursion formulas for the calculation of multilayer optical coatings are obtained. The Vlasov formulas are presented in the most simple form. It is shown that the results obtained can be used successfully in the calculation of absorbing layers in theory and practice. ***P. G. Kard.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 49-51.

The Mechanism of the Recombination Luminescence of Activated Alkali Halide Crystals. Presents the results of an investigation of recombination luminescence and photochemical transformations in alkali halide crystals activated by the ions Ga^+, Ge^{++}, In^{++}, Sn^{++}, Tl^+, and Pb^{++}, under excitation by X-rays and light in the exciton and activator absorption band regions, and also in the "zone-zone" bands. The role of electrons, holes, excitons, and sensitization processes in the recombination emission of phosphors of this class is considered. ***Ch. B. Lushchik, G. G. Liid'ya, I. V. Yaek, and E. S. Tiisler.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 1, July 1960, p. 35-39.

*** Investigations of Crystal Perfection in Semiconductor Crystals.** Chemical etching, decoration and X-ray diffraction microscopy are evaluated for use in the investigation of crystal perfection of semiconductor materials. It is pointed out that chemical etching is highly selective, in that different etching techniques may produce different features on the same crystal face. The number of dislocation pits may depend on the chemical composition, concentration, temperature of the reagent and its time of application, etc. For this reason, etch-pit counts never yield the true dislocation density, especially at low dislocation densities. ***G. H. Schwuttke.*** *Sylvania Technologist*, v. 13, no. 4, Oct. 1960, p. 122-128.

*** Interaction of a Test Particle With a Plasma. I. Distribution Function of Field Particles.** The distribution function of plasma particles is calculated in the case where a charged test particle travels through a plasma. Conditions for the steady-state solution and the neglect of the interaction between the plasma particles are investigated. These calculations may serve as a starting point to find the coefficients of dynamic processes in plasma. ***A. Ron and G. Kalman.*** *Annals of Physics*, v. 11, Oct. 1960, p. 240-259.

Factors Influencing the Luminescent Emission States of the Rare Earths. The number of electronic states from which luminescent emission by rare earth ions can be observed is dependent on the extent to which the host lattice perturbs their f-orbital electrons. Among others, perturbing influences may stem from the following sources: (a) coulombic affinities of the ions or molecules surrounding the rare earth ions for the electrons they share with the latter; (b) concentration effects, i.e., exchange coupling; (c) thermal effects, i.e., vibronic interactions. Results obtained on metal organic complexes, hydrates, fluorides, and tungstates are compared. The effects on emission of the rare earth ion concentration in the tungstates are compared for Eu, Tb, Dy, and Er at room temperature, and the influences of thermally excited interactions on the emission of Er are demonstrated. ***L. G. Van Uitert.*** *Electrochemical Society, Journal*, v. 107, Oct. 1960, p. 803-806.

The Spectrum of Thorium: New Secondary Standards of Wavelength. A sample of the Th spectrum is shown beside the Fe spectrum. Strong Th lines are uniformly distributed through the region, whereas Fe lines of proper intensity for comparison are infrequent. ***R. Zalubas.*** *National Bureau of Standards, Technical News Bulletin*, v. 44, Oct. 1960, p. 163-164.

* **Towards a Theory of the Crystallographic Point Groups.** Summarizes the theorems to be expected in a comprehensive theory of both the double and single crystallographic point groups. Based upon their decomposition as semidirect products, it is shown how the theory may yield a nomenclature for the groups and their representations, and a factored form for the projection operators belonging to the rows of the irreducible representations. ***Harold V. McIntosh.*** *Journal of Molecular Spectroscopy*, v. 5, no. 4, Oct. 1960, p. 269-283.

* **Molecular Association of CH_3OD Vapor.** The absorption of infrared radiation by methanol-*d* vapor in the region 2400 to 2800 cm^{-1} has been studied at 305 and 335 K as a function of vapor density. As in ordinary methanol, the results best correlate with the model that methanol-*d* vapor is composed of monomer, dimer, and tetramer, with little or no trimer present. The enthalpy of dissociation of the dimer is found to be approximately 5 kcal/mole, and that of the tetramer approximately 14 kcal/mole. ***Richard G. Inskeep, Frank E. Dickson, and Helen McKuskie Olson.*** *Journal of Molecular Spectroscopy*, v. 5, no. 4, Oct. 1960, p. 284-289.

* **The Effects of Infrared Radiation on Trapped Electrons in Excited ZnS-Phosphors.** By means of rise curves the number of trapped electrons in ZnS-phosphors can be determined. The effect of infrared irradiation added simultaneously to UV excitation is that of quenching; in addition the number of occupied traps (n_t) is found to be considerably reduced; approximately in the same ratio as the reduction of light. Since the free electron concentration (n) is also quenched by the addition of infrared to ultraviolet, there is some difficulty with the relationship: light = constant x n x n_t. ***B. Kramer and M. Schön.*** *Zeitschrift für Physik*, v. 160, no. 2, 1960, p. 145-148.

A Study of the Relation Between Electrokinetic Potential and Surface Charge Density. ***D. A. Haydon.*** *Royal Society, Proceedings*, v. 258, ser. A, Oct. 25, 1960, p. 319-328.

The Use of Gaussian (Exponential Quadratic) Wave Functions in Molecular Problems. I. General Formulae for the Evaluation of Integrals. II. Wave Functions for the Ground States of the Hydrogen Atom and of the Hydrogen Molecule. I. ***K. Singer.*** II. ***J. V. L. Longstaff and K. Singer.*** *Royal Society, Proceedings*, v. 258, ser. A, Oct. 25, 1960, p. 412-430.

Similarity Methods in Radiation Hydrodynamics. The extent to which problems in radiation hydrodynamics may be tackled by similarity methods is investigated for the case of spherical symmetry. In particular the problem of an intense explosion is considered; by the introduction of radiative heat flux the singularity in a solution by Taylor is removed. ***L. A. Elliott.*** *Royal Society, Proceedings*, v. 258, ser. A, Oct. 25, 1960, p. 287-301.

* **The Nuclear Magnetic Resonance Spectra of Four Spin Systems. I. The H^1 and F^{19} Resonance Spectra of 1-Fluoro, 2, 4-Dinitrobenzene.** ***B. D. Nageswara Rao and Putcha Venkateswarlu.*** *Indian Academy of Sciences, Proceedings*, v. 52, sec. A, no. 3, Sept. 1960, p. 109-121.

* **Vibrational Perturbation Theory.** Expressions are derived for the Jacobian of the coriolis ζ interaction constants and the centrifugal stretching constants (D_J, D_{JK}, etc.) with respect to the force constants in a vibrating-rotating molecule. ***I. M. Mills.*** *Journal of Molecular Spectroscopy*, v. 5, no. 4, Oct. 1960, p. 334-340.

Charged Dislocations in Lithium Fluoride. The application of strong electrostatic fields to bent LiF crystals produced small motions (0.1 to 6Å) of the bends which were analyzed in terms of the motion of charged dislocations. The charge on the dislocation core was positive and of the order of 10^{-4} to 10^{-3} e.s.u./cm, and it presumably arose from the inequality of the free energies of formation of positive ion and negative ion vacancies. Estimates of the electrostatic contribution to the critical shear strength based on these values of charge substantiate the suggestion by Eshelby, Newey, Platt, and Lidiard that much of this strength may be electrostatic in origin. ***R. L. Sproull.*** *Philosophical Magazine*, v. 5, ser. 8, Aug. 1960, p. 815-831.

Measurement of Thermal Diffusivity of Semiconductors by Ångström's Method. In its present form, the apparatus can be used between room temperature and 180 C. Application of the method is illustrated by an experiment using a single-crystal specimen of bismuth telluride. ***A. Green and L. E. J. Cowles.*** *Journal of Scientific Instruments*, v. 37, Sept. 1960, p. 349-351.

Simulation of Primary Aberrations of a Lens Using a Generalized Michelson Interferometer. The Michelson interferometer in its more generalized form is shown to be an analog of a lens suffering from primary aberrations. This is a true analog in the sense that no test lens is needed, except insofar as certain lenses form part of the interferometer. By suitable modification it could be made to simulate primary spherical aberration, primary astigmatism, and primary coma. ***M. V. R. K. Murty.*** *Optical Society of America, Journal*, v. 50, Nov. 1960, p. 1089-1102.

An Interferometric Method for Producing Variable-Frequency Sine-Wave Pattern. Three modifications of the Michelson interferometer are described to give straight fringes with linearly variable frequency. The modifications are done in such a manner that the order of interference is very low and hence fringes of high contrast are obtained. A brief theory of these modified versions of the Michelson interferometer is presented and conditions are derived for the production of fringes of best contrast. ***M. V. R. K. Murty.*** *Optical Society of America, Journal*, v. 50, Nov. 1960, p. 1084-1088.

* **Differential-Operator Approximations to the Linear Boltzmann Equation.** A measure of deviation from equilibrium of an ensemble of particles is proposed, which is physically appropriate and of especially simple form when expressed in terms of the expansion coefficients of the ensemble distribution function with respect to the system of orthogonal polynomials obtained by using the equilibrium distribution function as weight function. The linear Boltzmann operator can then be expanded in a series of terms which, under certain circumstances, may be regarded as of successively diminishing magnitude in their effect on the rate of approach to equilibrium. ***Armand Siegel.*** *Journal of Mathematical Physics*, v. 1, no. 5, Sept.-Oct. 1960, p. 378-390.

* **Zero-Point Energy of an Electron Lattice.** At very low densities an electron gas in a compensating uniform background of positive charge crystallizes into a bcc lattice for which the correlation energy per electron is $(-1.792/r_s)$ry. At higher densities, the first correction to this result arises from the zero-point energy of the electrons, which can be expanded in terms of the even moments of the frequency spectrum. We have computed the first five nonvanishing moments and have estimated the contribution to the zero-point energy from the remaining moments using their known asymptotic behavior. This procedure leads to the value $(2.638/r_s^{\frac{9}{7}})$ry for the zero-point energy per electron. The low temperature specific heat per electron is found to be $56.21\ k r_s^{\frac{9}{7}}(kT)^3$ry. The range of r_s values for which these results should be valid is discussed on the basis of Lindemann's melting formula. ***Rosemary A. Coldwell-Horsfall and Alexei A. Maradudin.*** *Journal of Mathematical Physics*, v. 1, no. 5, Sept.-Oct. 1960, p. 395-404.

* **On the General Theory of the Approach to Equilibrium. I. Interacting Normal Modes.** A general method which permits the derivation of the equations which describe the approach to equilibrium correct to an arbitrary finite order in the coupling constant is presented. This method is applied to normal modes interacting through three-phonon processes. ***I. Prigogine and F. Henin.*** *Journal of Mathematical Physics*, v. 1, no. 5, Sept.-Oct., 1960, p. 349-371.

* **Relationship Between the Statistic Variation Principle and the Method of Forming Partial Sums for Diagrams in the Thermodynamic Perturbation Theory for a Modified Statement of the Problem of Bose-Einstein's Non-Ideal System.** The problem is discussed in formulas and calculations.

The equivalency of the statistic variation principle and of the summation of the special class of temperature diagrams is shown. A similar result takes place in the problem of a Fermi-Dirac non-ideal system. (*In Russian.*) Sviaz' statisticheskogo variatsionnogo printsipa s metodom chastichnogo summirovaniia diagramm termodinamicheskoĭ teorii vozmushehenīĭ v modifitsirovannoĭ formulirovke problemy neideal'noĭ Boze-Eĭnshteĭnovskoĭ sistemy. ***V. V. Tolmachev.*** *Akademiia Nauk SSSR, Doklady,* v. 134, no. 6, Oct. 1960, p. 1324-1327.

* **Constantan as a Thermoelement.** Deals with the results of wire production for constantan thermoelements, the properties of said wires, and the applied methods for thermoelectromotive force measurement of thermoelements of iron-constantan. (*In Polish.*) Konstantan na termoelementy. ***Witold Babiński.*** *Rudy i Metale Niezelazne,* v. 5, no. 8, Aug. 1960, p. 322-326.

* **Physical Bases of the Technical Application of Molecular Acoustics of Small Amplitudes.** Instruments for the determination of properties or for use in control devices and in automation rely essentially on the relations between the property or the quantity of state to be measured and the sound absorption, the velocity of sound, and its frequency. (*In German.*) Physikalische Grundlagen der technischen Anwendung der Molekularakustik kleiner Amplituden. ***W. F. Nosdrew.*** *Forschung auf dem Gebiete des Ingenieurwesens* (Ausgabe B), v. 26; *VDI-Forschungsheft* 480, 1960, p. 101-107.

* **A Contribution to the Many-Valued Character of the Scalar Magnetic Potential in the Hydromagnetic Stability Problem of a Plasma.** Bernstein, Frieman, Kruskal, and Kulsrud have found a variational principle (energy principle) which provides a necessary and sufficient condition for the stability of a plasma configuration surrounded by a vacuum and an external conductor. In this energy principle, the perturbed magnetic field in the vacuum is derived from a vector potential. In the present investigation, the energy principle is formulated with the help of a magnetic scalar potential instead of the vector potential, which simplifies the application of the principle. (*In German.*) Zur Mehrwertigkeit des skalaren magnetischen Potentials beim hydromagnetischen Stabilitätsproblem eines Plasmas. ***R. Lüst and E. Martensen.*** *Zeitschrift für Naturforschung,* v. 15a, Aug. 1960, p. 706-713.

Contributions to the Development of Physics. This collection of articles, made for the 70th birthday of Professor Paul Scherrer of the Federal Technical College of Zürich, Switzerland, comprises such topics as paramagnetism, Seignette electricity, physics of iron, neutron physics, nuclear photoprocesses, electronics and nuclear physics, accelerators, beta decay, nuclear systematics, structure of the color centers in alkalihalides, gas discharges, and physics in chemistry. Papers in German, French, and English. Beitrage zur Entwicklung der Physik. ***H. Frauenfelder, O. Huber, and P. Stähelin, editors.*** 254 pp. 1960. Birkhäuser Publishing House, Basel, Switzerland. (QC3 F86b)

Plasma Physics. ***J. G. Linhart.*** 278 pp. Interscience Publishers, New York. (QC711 L64p)

Interaction Between Cold Plasmas and Guided Electromagnetic Waves. The microwave cavity method for the measurement of various parameters of a cold plasma in the presence of a static magnetic field is examined. Emphasis is placed on the determination of the limits of validity of the perturbation theory for various mode configurations of a cylindrical cavity coaxial with a plasma column and coaxial with the static magnetic field. The presence of a magnetic field removes the degeneracy and causes the resonant frequency to be double-valued. An experimental test of the validity of the perturbation method can be had by comparing the two resonant frequencies. The relation is given between the characteristics of the various modes and the propagation of plane waves in infinite uniform plasmas. ***S. J. Buchsbaum, Lyman Mower, and Sanborn C. Brown.*** *Physics of Fluids,* v. 3, no. 5, Sept.-Oct. 1960, p. 806-819.

Shock Wave and Solitary Wave Structure in a Plasma. Plane steady shock waves and solitary waves in a H plasma without external magnetic fields are studied, using a simple kinetic theory model to describe the plasma. This model uses a Mott-Smith distribution for the protons and a local Maxwellian distribution for the electrons. Charge separations occur inside the shock front because of the proton-electron mass difference. The proton and electron densities, and the electric field, have an

oscillatory fine structure with characteristic length $\sim 10M\lambda_D$, where M is the Mach number and λ_D the Debye length, going through the shock. In these oscillations, the densities overshoot their final Rankine-Hugoniot condition values. The distance in which the oscillations decay to $1/e$, which we take as the shock width, is $\sim 4\lambda$, where λ is the mean free path in the unshocked gas, in the range of Mach numbers considered. There are no continuous solutions for this model above Mach 2.19. The peak electric fields inside the shock are large; in a plasma of $\lambda/\lambda_D = 2 \times 10^4$, the electric field reaches 2.2×10^6 v/cm in a Mach 2.1 shock. ***O. W. Greenberg and Y. M. Trève.*** *Physics of Fluids,* v. 3, no. 5, Sept.-Oct. 1960, p. 769-785.

Approximations in the Theory of Dense Fluids. A fluid of rigid spheres in equilibrium is considered from a viewpoint which allows the deduced equation of state to reflect very sensitively the accuracy of two approximations to the triplet distribution function. Specifically, these approximations are: (1) the usual Kirkwood superposition scheme, and (2) assumption that the correlation of excess particles near a fixed particle pair is additively composed of the excessed induced individually by each member of the pair (linear correlation field hypothesis). Granted only these hypotheses, each in turn, the rigorous statistical mechanical relations between rigid-sphere distribution functions and the thermodynamic pressure and compressibility lead unambiguously to nonlinear first-order differential equations for the pressure as a function of density. The simply obtained numerical solutions clearly demonstrate that assumption (1) is considerably superior to (2). ***Frank H. Stillinger, Jr.*** *Physics of Fluids,* v. 3, no. 5, Sept.-Oct. 1960, p. 725-734.

* **Negative Photodielectric Effect.** Deep-cooled Cd selenide specimens were used in studying the processes peculiar to the photodielectric effect of the first type, and especially the decrease of the active conductivity during optical excitation. The negative photodielectric effect testifies to the existence of a relaxation polarization of the current carriers localized on small capture levels. (*In Russian.*) Otritsatel'nyĭ fotodielektricheskiĭ effekt. ***Ia. A. Oksman and A. V. Burlakov.*** *Akademiia Nauk SSSR, Doklady,* v. 134, no. 1, Sept. 1960, p. 77-80.

* **New Equations for the Temperature Function of Specific Heats of Perfect Gases.** The well-known two- and three-member forms of equation for specific heats are not satisfactory from the accuracy viewpoint. With new measurement values, new multi-member power series of high accuracy are developed for twenty-five technical gases; their calculation results are compared with the values measured and their validity limits are determined. (*In German.*) Neue Gleichungen für die Temperaturfunktion der spezifischen Wärmen vollkommener Gase. ***H. Faltin.*** *Technik,* v. 15, Sept. 1960, p. 592-596.

Intermediate Image Pair Spectrometer Measurements of the Electromagnetic Radiations From Some Light Nuclei. An Fe-free intermediate image pair spectrometer was built and used to study the pair spectra of O^{16}, Ca^{40}, and Ca^{48}, and the radiations following the deuteron bombardment of Al and Na with the following new results: The number of magnetic monopole transitions from the 10.98 Mev (0^-) state in O^{16} is less than 10^{-4} times the number of cascade transitions through the 7.12 Mev (1^-) state, indicating that there is no unexpectedly strong interaction between the pair and nuclear fields. The low yield of electric monopole transitions from the 3.8 Mev state of Ca^{48} shows that this state is not an O^+ first excited state, as had been expected by analogy to Ca^{40}. Several γ rays between 6 and 11 Mev have been observed after the deuteron bombardment of a natural Na target, and are found to be reasonably consistent with levels in Mg^{24} observed by measuring neutron groups. ***Karl Erik Eklund.*** *U. S. Atomic Energy Commission, CU(PNPL)*-196, May 12, 1960, 112 pp. (UF767 Un3.1cu Contin.)

* **Diffraction in Three Dimensions.** Preliminary development of an essential unifying principle underlying all diffraction processes. ***C. A. Taylor.*** *Contemporary Physics,* v. 1, no. 6, Aug. 1960, p. 445-452.

Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Containment of a plasma by a travelling magnetic field, hydrodynamics of a low-pressure plasma, magnetic hydrodynamic waves in a rarefield plasma, motion of

charged particles in a magnetic trap, the motion of charged particles in rapidly oscillating electromagnetic fields, stabilization of a plasma by means of a system of rods, study of the stability of a cylindrical plasma column by a method employing the Bolzmann equation, and other problems are discussed. ***M. A. Leontovich, editor.*** v. IV. 510 pp. 1960. Pergamon Press, New York. (QC786 Ak13.1ftr)

* **The Magnetic Susceptibility of Ag-Mn and Cu-Mn Solid Solutions Between 1.2°K and 368°K.** The alloys obey a Curie-Weiss law up to and including liquid N temperatures. The p_{eff}, effective magneton number, values derived for the Mn atom are discussed and compared with other published values. At the liquid H temperatures, the alloys no longer obey a Curie-Weiss law. It has been found that some of the alloys show a transition from a paramagnetic into an antiferromagnetic state. This occurs at a certain temperature, known as the Néel temperature *Tx.* ***A. Van Itterbeek, W. Peelaers, and F. Steffens.*** *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods,* v. 8, no. 4, 1960, p. 337-348.

* **Energy Transfer by Gravitation in Newtonian Theory.** The problem is considered as to whether, in accordance with Newtonian theory, energy can be transferred from one system to another across empty space by gravitational interaction alone. Familiar examples of apparent energy transfer by this means do not give an unambiguous answer since they involve some net change of gravitational potential energy, and this is not localized in the theory. ***H. Bondi and W. H. McCrea.*** *Cambridge Philosophical Society, Proceedings,* v. 56, pt. 4, Oct. 1960, p. 410-413.

PLASTICS

The Biological Deterioration of Plastics. Vulnerability of polymers to microorganisms, insects and rodents. ***H. J. Hueck.*** *Plastics (London),* v. 25, Oct. 1960, p. 419-422.

* **Analysis and Testing of Plastics.** Study with comments upon newly available equipment. ***G. C. Ives.*** *Fibres and Plastics,* v. 21, Oct. 1960, p. 307 + 4 pages.

* **Electrophoretic Mobility and Electrochemistry of Latex Systems.** Electrophoretic behavior of a polystyrene latex measured at various soap and salt concentrations is explained on the basis of the Stern theory of the double layer. A theoretical explanation of the variation in mobility with change in soap and salt concentrations and of the conditions for maximum mobility is given. ***C. L. Sieglaff and J. Mazur.*** *Journal of Colloid Science,* v. 15, no. 5, Oct. 1960, p. 437-451.

* **Colouring of Plastics—Processing Properties of Pigments.** ***C. Musgrave.*** *Rubber Journal and International Plastics,* v. 139, no. 16, Oct. 15, 1960, p. 628-631.

Polyester Film in Echo 1 Satellite. The sphere was fabricated from du Pont Mylar polyester film; 0.0005 film is covered with vapor-deposited Al to provide radio wave reflectivity of 98% up to frequencies of 20,000 mc. The weight of the film in the sphere is 132 lb and the Al covering 4 lb. *British Plastics,* v. 33, Oct. 1960, p. 449.

Thermal Degradation of Polymers. Report on Society of Chemical Industry Symposium summarized. *British Plastics,* v. 33, Oct. 1960, p. 473 + 4 pages.

* **The Effect of Water on the Bursting Strength of Rigid PVC Pipes.** Moisture absorption and creep strength curves were determined for a number of rigid PVC pipes at 60 C. It was found that moisture absorption cannot be taken as a criterion for the behavior of the pipe. (*In German.*) Der Einfluss von Wasser auf die Bruchfestigkeit von Hart-PVC-Rohren. ***A. K. van der Vegt.*** *Kunststoffe,* v. 50, Oct. 1960, p. 537-540.

Variability in Functional Aging of Mylar Polyester Film for Hermetic Motor Applications. A study on batch-to-batch variability of commercial production-grades of Mylar film to disclose any potential adverse effects on hermetic motor systems. Both classical tests (density, viscosity, etc.) and functional tests were conducted. Results are summarized and test methods

described. No significant variations were found. ***L. S. Lazar and W. V. Olszewski.*** *Electro-Technology,* v. 66, no. 5, Nov. 1960, p. 119-123.

a

* **Urethane Materials Meet Urgent Needs.** Space vehicle applications. ***David J. Jolliffe.*** *Military Systems Design,* v. 4, no. 5, Sept.-Oct. 1960, p. 22-25.

* **Polymerization of Acetone.** It is shown on the example of acetone that by using the principle of preliminary regulation of monomeric molecules in a reactive system one can realize the polymerization of substances, which cannot polymerize under common conditions. In this case such a regulation was achieved at the expense of the crystallization of the monomer. At the moment of realization of the phase conversion of the type disorder-order in a glass-covered monomer originate conditions kinetically favorable for the formation of polymeric bonds of regulated molecules of a monomer. (*In Russian.*) Polimerizatsiia atsetona. ***V. A. Kargin, V. A. Kabanov, V. P. Zubov, and I. M. Papisov.*** *Akademiia Nauk SSSR, Doklady,* v. 134, no. 5, Oct. 1960, p. 1098-1099.

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* **Electric Conductivity of Polymers With Conjugate Bonds.** Series of the investigated samples show an electric conductivity which exceeds by some orders the electric conductivity of common organic dielectrics. (*In Russian.*) Elektroprovodnost' polimerov c sopriazhennymi sviazami. ***E. I. Balabanov, et al.*** *Akademiia Nauk SSSR, Doklady,* v. 134, no. 5, Oct. 1960, p. 1123-1126.

d

* **Evaluation of Dialkyl 11-Phosphonoundecanoates and *P,P*-Dialkyl 9(10)-Phosphonostearates as Plasticizers for Vinyl Chloride Polymers.** All the 9(10)-phosphonostearates and two of the undecanoates are outstanding in having low migration losses in addition to imparting low stiffening temperatures to poly(vinyl chloride). This desirable combination of characteristics has not been observed previously. The *P, P*-dialkyl 9(10)-phosphonostearates are also unusual because they not only have widely separated polar groups, but they also contain a C_8 or C_9 branch. ***Daniel Swern, W. E. Palm, Richard Sasin, and L. P. Witnauer.*** *Journal of Chemical and Engineering Data,* v. 5, no. 4, Oct. 1960, p. 484-485.

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How Molding Conditions Affect Polypropylene. Indications are that wide variations in machine conditions have little effect on properties. One should avoid subjecting polypropylene to stuck temperatures in excess of about 600 F for appreciable lengths of time. If polypropylene is long subjected to high temperatures, it develops an odor and some discoloration. ***Howard Robb.*** *Modern Plastics,* v. 38, no. 3, Nov. 1960, p. 116 + 5 pages.

g

* **Infrared Spectra of Crystalline and Stereoregular Polymers. I. Polypropylene.** ***C. Y. Liang and F. G. Pearson.*** *Journal of Molecular Spectroscopy,* v. 5, no. 4, Oct. 1960, p. 290-306.

h

* **Ultimate Tensile Properties of Amorphous Polymers.** ***Thor L. Smith.*** *SPE Journal,* v. 16, Nov. 1960, p. 1211-1216.

* **Applicability and Confectioning of Polyester Resins to Bonding.** Several unsaturated polyester resins are applicable as cold-setting adhesives for metals. Setting is obtained by an oxido-reduction system (dimethyl aniline/benzoyl peroxide). Dry benzoyl peroxide yields higher strengths than benzoyl peroxide paste. Bonding strength is also increased by adding fillers. Benzoyl peroxide can be distributed in the filler and the mixture added to the resin. Setting time was reduced by adding dark ground slate or metal powders, and that the last-mentioned can even dispense with accelerators. (*In German.*) Über die Verwendbarkeit und Konfektionierung von Polyesterharzen zu Klebzweeken. ***K. H. Küssner.*** *Plaste und Kautschuk,* v. 7, Sept. 1960, p. 431-432.

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* **The Gamma-Ray Induced Grafting of Some Polymers Onto Natural Silk and Capron.** Analysis of the infrared absorption spectra indicates that the CN-group has been incorporated in the silk and capron; the H bonds of the groups—CO—NH—being preserved. It is shown that as a result of irradiation of silk in air, breakdown of the main fibroin chain and loss in packing density of the macromolecules take place. (*In Russian.*) Privivka nekotorykh monomerov k natural'nomu shelku i kapronu pri pomoshch γ-luchei. ***S. A. Azimov, Kh. U. Usmanov,***

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N. V. Kordub, and S. I. Slepakova. *Vysokomolekuliarnye Soedineniia,* v. 2, no. 10, Oct. 1960, p. 1459-1462.

* **Preparation of Some Graft Copolymers by Ozonization.** The method of ozonization has been applied to the preparation of graft copolymers from polystyrene and vinyl acetate, polyisobutylene and styrene, and polyethyleneterephthalate and acrylic acid. It has been shown that the graft copolymer from the system polystyrene–vinylacetate is produced with the least amount of the grafted-on part (polyvinylacetate) as compared with the other systems. (*In Russian.*) O poluchenii nekotorykh privitykh sopolimerov metodom ozonirovaniia. ***P. V. Kozlov, M. M. Iovleva, A. Kh. Khakimova, and A. Zezin.*** *Vysokomolekuliarnye Soedineniia,* v. 2, no. 10, Oct. 1960, p. 1575-1579.

* **Polymerization of Octamethylcyclotetrasiloxane in the Presence of Tin Tetrachloride.** It has been shown that on interaction between octamethylcyclotetrasiloxane and stannic chloride at temperatures above 100 ring cleavage takes place, linear polymers being formed. As a result of the polymerization, soluble products are obtained with a mean molecular weight of about 350,000. The polymerization rate increases with increase in catalyst concentration and with elevation of the polymerization temperature. (*In Russian.*) Polimerizatsiia oktametiltsiklotetrasiloksana v prisutstvii khlornogo olova. ***K. A. Andrianov and S. E. Iakushkina.*** *Vysokomolekuliarnye Soedineniia,* v. 2, no. 10, Oct. 1960, p. 1508-1511.

* **Investigation of Mechanical Degradation of Polymethylmethacrylate and Polystyrene by Molecular Weight Changes.** The intrinsic viscosities of polymethylmethacrylate and polystyrene before and after reduction in size by cutting off shavings of various thickness (from 10 to 75 μ) on a high-speed lathe (1.6 to 70 cm/sec) have been determined. The value of the diffusion coefficient was found to be 10^{-4}cm^2/sec which cannot be associated either with gaseous diffusion or heat flow in the polymer. (*In Russian.*) Izuchenie mekhanicheskoĭ destruktsii polimetilmetakrilata i polistirola po izmeneniiu ikh molekuliarnykh vesov. ***M. P. Vershinina and E. V. Kuvshinskii.*** *Vysokomolekuliarnye Soedineniia,* v. 2, no. 10, Oct. 1960, p. 1486-1493.

* **Stereoregular Polymers. VI. Copolymerization With the Ziegler Catalysts.** Binary copolymerization of styrene, allyltrimethylsilane and 3-butenyltrimethylsilane was investigated using the Ziegler catalyst at 70 C. It was found to be possible to separate the crystalline part of copolymers by fractional extraction into two kinds of genuine crystalline copolymers, each of which has an extremely different composition from the other. ***Shunsuke Murahashi, Shun'ichi Nozakura, and Masao Sumi.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 9, Sept. 1960, p. 1170-1174.

* **The Self-Diffusion of Surface Active Agents in Nylon.** Self-diffusion rates in nylon of sodium dodecyl sulfate and sodium tetra-decyl sulfate, and also of sulfuric acid and hydrochloric acid were studied, using the nylon plates and the radioactive tracers. ***Makoto Hayashi.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 9, Sept. 1960, p. 1184-1188.

* **Ethylene Copolymers.** Specialized resins offering stress cracking resistance and long-term load bearing ability. ***J. E. Pritchard, R. J. Martinovich, and P. J. Boeke.*** *Plastics Technology,* v. 6, Oct. 1960, p. 31-35.

* **Polyether-Based Flexible Urethane Foams.** ***E. A. Packer and J. F. Wood.*** *Rubber and Plastics Age,* v. 41, Oct. 1960, p. 1174-1178.

* **Polymerization and Condensation Reaction of N-Methylol Acrylamide Within Cotton Fabric.** Observes results of the polymerization and condensation reactions of N-methylolacrylamide within cotton fabric and discusses the effect on such physical properties as crease resistance, tear strength, and abrasion resistance of the treated fabric. ***H. Kamogawa, R. Murase, and T. Sekiya.*** *Textile Research Journal,* v. 30, Oct. 1960, p. 774-781.

* **Effect of Melting Conditions on the Crystallisation of Polypropylene.** When the melting temperature is increased, the melting period being kept constant, any surviving solid nuclei present in the melt are removed gradually, a fact which is proved by the increase in the Avrami constant and the specific volume of the amorphous phase. By simple extrapolation the

temperature necessary to produce a melt completely free from nuclei to 140 C was determined. This was found to be 235–240 C. (*In German.*) Einfluss der Schmelzbedingungen auf die Kristallisation von Polypropylen. ***Josef Majer.*** *Kunststoffe,* v. 50, Oct. 1960, p. 565-567.

Physical Properties of Vinyl Polymers. II. The Glass-Transition Temperature of Block and Random Acrylonitrile+Methyl Methacrylate Copolymers. III. X-Ray Scattering in Block, Random and Graft Methyl Methacrylate+Acrylonitrile Copolymers. II. ***R. B. Beevers and E. F. T. White.*** III. ***R. B. Beevers, E. F. T. White, and L. Brown.*** *Faraday Society, Transactions,* v. 56, Oct. 1960, p. 1529-1541.

* **Polycondensation of Alkylene Dichlorides With Alkylene Polyamines.** Polycondensation resulted in high molecular weight soluble polymers or insoluble gels, depending on the ratio of the reactants and the extent of reaction. The functionality of a polyfunctional compound containing groups of unequal reactivities can be determined experimentally. ***T. J. Suen, A. Senior, D. L. Swanson, and Y. Jen.*** *Journal of Polymer Science,* v. 45, Aug. 1960, p. 289-303.

POLLUTION AND WASTES

* **Possibilities for Removing Industrial Fats and Detergents in Waste Water.** The purification of oil- and fat-containing waste water was carried out according to Bradford's purification basin. The causes of oil soil in water, also the methods of removing mineral oils and their accompanying substances in waste water are described. The questions of detergents-adsorption on slimes and the problems of biological decomposition are discussed in detail. (*In German.*) Möglichkeiten der Beseitigung von industriellen Fetten und Detergentien im Abwasser. ***W. Husmann.*** *Fette, Seifen, Anstrichmittel,* v. 62, no. 9, Sept. 1960, p. 790-796.

The Assessment of "Softness" in a Synthetic Detergent by Biological Means. ***F. W. Roberts.*** *Chemistry & Industry,* 1960, no. 42, Oct. 15, p. 1282-1284.

* **The Problem Created by the Smokes Produced by Electrometallurgical Furnaces.** Analyzes the granulometric composition of the dusts contained in the smokes of ferro-silicon furnaces and the conditions of use of dry- and wet-dust removal apparatus, and extends the study to other types of furnaces involving the treatment of ferro-manganese, ferro-chromium, ferro-tungsten, ferro-nickel and calcium carbide. (*In French.*) Problème des fumées émises par les fours électrométallurgiques. ***W. Muhlrad.*** *Chaleur & Industrie,* 1960, no. 422, Sept., p. 237-255.

RELIABILITY ENGINEERING

* **Reliability: An Engineering Problem.** The necessity of coordination, the value of design review, the use of accumulated experience, the hazard of non-standard parts are discussed. ***Max M. Tall.*** *Industrial Research,* v. 2, no. 5, Oct.-Nov. 1960, p. 22-27.

* **Reliability: A Management Problem.** Reliability can be measured on devices, systems, and accomplishment of a mission. One has to search for failure and has to be ready for a quick change if it is necessary to do so. ***John A. Connor.*** *Industrial Research,* v. 2, no. 5, Oct.-Nov. 1960, p. 28 + 4 pages.

* **The Assessment of the Reliability of Magnetic Tape for Data Processing.** A large number of specimens of tape have been tested for drop-outs over a wide range of operating conditions. A method of tape testing is suggested which appears to be more basic than the present "go/no-go" type of test. The method permits batch testing for most purposes and saves valuable time in the selection of suitable tape even if complete testing is insisted upon. ***R. Noble.*** *British Institution of Radio Engineers, Journal,* v. 20, Oct. 1960, p. 737-742.

RUBBER AND ELASTOMERS

*** Improved Synthetic Rubbers for the Modern Tire.** ***T. A. Riehl.*** *Chemistry in Canada*, v. 12, Oct. 1960, p. 28-31.

*** Dynamic Mechanical Properties of Some New Elastomers.** Experimental results presented graphically which show the similarity of polybutadiene and polyisoprene with NR: ethylene/propylene copolymers with SBR, in the properties of power loss, resilience and modulus. ***A. D. Dingle.*** *Chemistry in Canada*, v. 12, Oct. 1960, p. 32-34.

Longitudinal Wave Propagation in Stretched Polymers. The wave equation is derived for the propagation of longitudinal waves along a stretched filament of a highly elastic material. Tension in the filament reduces the effective modulus by twice the product of Poisson's ratio and the tensile traction, leaving the internal viscosity term unchanged. This result is illustrated by measurements of continuous 1 kcps wave propagation in natural rubber at 50 C, where the damping is small ($\tan \delta < 0.1$). ***Peter Mason.*** *Journal of Applied Physics*, v. 31, Oct. 1960, p. 1706-1708.

*** The Effect of Gel and Structure on the Properties of cis-1,4-Polyisoprene.** The effects of certain polymerization variables upon the production of isoprene polymers made by Ziegler catalysis are discussed. Synthetic cis-1,4-polyisoprene can be made to have both the raw and the vulcanizate properties of Hevea rubber. Of the systems known, only Ziegler catalysis produced synthetic cis-1,4-polyisoprene meets all requirements. (*In German.*) Wirkung von Gel und Struktur auf die Eigenschaften von cis-1,4-Polyisopren. ***C. F. Gibbs, S. E. Horne, Jr., J. H. Macey, and H. Tucker.*** *Kautschuk und Gummi*, v. 13, Oct. 1960, p. 336WT + 4 pages.

*** Properties of Rubber.** Present state of knowledge for modern applications. ***D. F. Aitken.*** *Engineering Materials and Design*, v. 3, Nov. 1960, p. 676-680.

*** Studies on Tire Cords at Dynamical Tensile Stress Alternation.** Nylon and rayon cords were examined by the dynamical yarn tester according to Meskat, Rosenberg, and Hoffmann. By means of the measuring results, the evaluation of the hysteresis loop is discussed and a simplified method is given. The effect of test conditions—as stroke, initial stress, load-frequency, and temperature—on the physical data of tire cord are treated. (*In German.*) Untersuchungen an Reifencorden unter dynamischer Zugwechselbeanspruchung. ***Hans Meumann.*** *Faserforschung und Textiltechnik*, v. 11, Sept. 1960, p. 444-456.

*** New Methods of Elastomer Synthesis.** Synthetic national rubber, other new elastomers, possible modifications of natural rubber, natural rubber's future are discussed. *Rubber Journal and International Plastics*, v. 139, no. 17, Oct. 22, 1960, p. 694 + 1 page.

*** Snythetic Rubber Symposium.** Stereo rubbers, anionic polymerization, and controlling structure are discussed. *Rubber Journal and International Plastics*, v. 139, no. 17, Oct. 22, 1960, p. 686 + 1 page.

*** Determination of Cohesion Energy Densities of Some Synthetic Rubbers.** The cohesion energy densities of the rubbers SKS-30A, SKS-30ShKhP, SKMVP-5tr, SKMVP-15A, SKD-1, SKS-30-1 were determined. It was shown that pyridine and carboxyl groups impart different properties to the polymers. In the amounts investigated, carboxyl groups raise the cohesion energy, but have little effect on the rubber-solvent interaction, whereas pyridine groups practically leaving the cohesion energy unchanged, have a strong influence on the nature of interaction between the rubber and the solvent. (*In Russian.*) Opredelenie plotnosti energii kogezii nekotorykh sinteticheskikh kauchukov. ***V. E. Basin and A. G. Shvartz.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 10, Oct. 1960, p. 1470-1474.

*** Comparing Neoprene-Based Contact Adhesives.** Figures showing the relative strength and adhesion of two contact adhesives, are given. They indicate that there are fundamental differences between apparently similar contact adhesives. ***Ingemar Nyman.*** *Adhesives & Resins*, v. 8, Sept.-Oct. 1960, p. 84-85.

*** Organic Chemicals for Synthetic Rubber.** Discusses changes which have taken place in the development of organic chemicals for synthetic rubbers since the 1st International Synthetic Rubber Symposium organized by *Rubber and Plastics Age*, in 1957. ***W. McG. Morgan.*** *Rubber and Plastics Age*, v. 41, Oct. 1960, p. 1179-1182.

*** Polyurethane Elastomers.** Chemistry, processing, properties and applications of millable gums and liquid polymers are reviewed. ***Mitchell Borr.*** *Chemistry in Canada*, v. 12, Oct. 1960, p. 35-39.

*** Advances in Silicone Rubber Polymers With Special Reference to Compounding.** ***C. W. Roush and A. M. Dunlop.*** *Chemistry in Canada*, v. 12, Oct. 1960, p. 40-43.

*** A New Method for Measuring the Degree of Crosslinking in Elastomers.** Method involves measuring equilibrium compression modulus at very small deformations on solvent-swollen samples. ***E. F. Cluff, E. K. Gladding, and R. Pariser.*** *Journal of Polymer Science*, v. 45, Aug. 1960, p. 341-345.

*** On the Mechanism of Ozone Degradation of SBR.** Techniques of ultracentrifugation and viscometry were utilized to follow molecular changes induced by ozone. Chemical changes were investigated by measuring variations in active oxygen group concentration. Results suggest that the autocatalytic degradation of uninhibited SBR was initiated by a random ozone attack at a double bond on the unozonized chain, producing an ozonide which decomposed spontaneously, forming small segments with activated chain-ends. ***A. D. Delman, B. B. Simms, and A. E. Ruff.*** *Journal of Polymer Science*, v. 45, Aug. 1960, p. 415-434.

SPACE HEATING AND CONDITIONING

*** Room Air Distribution.** Discusses the distribution of conditioned air after it has been transmitted to the conditioned space. *Air Conditioning, Heating and Ventilating*, v. 57, Nov. 1960, p. 70-85.

*** Montreal's Approach to Space-Heating Rates.** Development of a general-purpose rate for domestic customers in Montreal who heat their homes either solely or principally by electricity followed discovery of 3500 such customers on system despite zero promotion. ***J. C. Antliff.*** *Electric Light and Power*, v. 38, no. 21, Nov. 1, 1960, p. 36 + 1 page.

*** 6 Ways to Recover Heat in Factories.** Where there's internal heat gain there's usually a way to recover heat. Where there's air exhausted there's often a way to squeeze out heat. ***R. N. Becker.*** *Air Engineering*, v. 2, no. 11, Nov. 1960, p. 38 + 6 pages.

*** Air Sanitation With Ultraviolet Light. II.** A practical engineering guide on application of ultraviolet light for air sanitation in schoolrooms, bakeries, pharmaceutical plants, meat packing, wherever air should be sterile. ***J. C. Hoffman and R. Nagy.*** *Air Engineering*, v. 2, no. 11, Nov. 1960, p. 43 + 4 pages.

*** Engineering Fundamentals of Air Sanitation With Ultraviolet Light. III.** The conclusion of this series deals with ultraviolet air sanitation for baking and meat packing industries. Highlighted is an informative discussion on effects of negative air ionization. ***John C. Hoffman and Rudolph Nagy.*** *Air Engineering*, v. 2, no. 12, Dec. 1960, p. 46-50.

*** The Problem of Noise.** The characteristics of sound; typical operational noises; the harmful effect of noise; surveying the noise problem; ways of controlling noise. *American Pressman*, v. 70, no. 11, Nov. 1960, p. 24 + 2 pages.

TEXTILES, FIBERS, LEATHER, AND PAPER

*** Study of the Effect of the Elastic Tissue of Hide on the Physical Properties of Leather.** Removal of elastic tissue from cowhides by means of Viokase enzyme causes the leather pro-

duced from such stock to have softer temper, coarser break, and more drawn grain than the corresponding control leather. Physical tests indicate that the removal of elastic tissue from cowhide stock caused the leather produced from such stock to have higher tensile strength and higher stitch tear strength as well as a more flexible grain. ***Conrad L. Ornes, William T. Roddy, and Edward F. Mellon.*** *American Leather Chemists Association, Journal,* v. 55, Nov. 1960, p. 600-621.

* **Towards a More Automatic Papermaking Process—Some Recent Applications.** The application of process controls to the stock preparation, paper machine, and auxiliary plant of No. 13 machine at Aylesford Paper Mills is described. The semi-automatic hydrapulping system, consistency control, and the sulfite, groundwood and china-clay blending system are described. ***R. C. Gardner.*** *Pulp and Paper Magazine of Canada,* v. 61, Oct. 1960, p. T485-T489.

* **Studies on the Enzyme Depilation of Hides and Skins. V. Properties of Protease and Unhairing Enzyme Activity. Produced by *Bacillus megatherium 3E (1).* VI. Adsorption of Protease Produced by *Bacillus megatherium 3E* on Various Adsorbents. VII. Properties of Protease Produced by *Bacillus megatherium 3E (2).*** (*In Japanese.*) V.-VI. ***Harukazu Toyoda and Akira Futami.*** VII. ***Harukazu Toyoda, Akira Futami, and Masayoshi Kikkawa.*** *Government Chemical Industrial Research Institute, Tokyo, Reports,* v. 55, Oct. 1960, p. 373-411.

* **The Heat Treatment of Orlon Acrylic Fiber to Render It Fireproof.** Fiber AF is fireproof and has an unusually high resistance to destruction upon short-time thermal irradiation. Upon continued exposure to high temperatures, Fiber AF gradually loses its tensile properties. ***W. G. Vosburgh.*** *Textile Research Journal,* v. 30, Nov. 1960, p. 882-896.

* **Leather From "Reconstituted" Skin.** Analyzes the contents of two American patents. The general purpose of the first was the regeneration of the portion of the true dissolved tropocollagen inside the pasty fiber mass into fibrils. The new collagen fibrils must produce the cohesion between the collagen fibers first uncombined in the collagen paste or fiber bundles, so that these bundles grow into an undefined skin and form a unit which, by its structure, can compare with a skin fiber mesh. According to the second patent, the main part of the fiber mass before size reduction is tanned with formaldehyde and the mixture of tanned and untanned fibers after forming is dehydrated into a membrane by means of acetone. (*In German.*) Leder aus "rekonstituierter" Haut. *Leder,* v. 11, Sept. 1960, p. 227-229.

* **Continuous Shredding of Alkali-Cellulose in a Viscose Pilot Plant.** Deterioration occurs in alkali-cellulose when passed through a continuous high-speed laboratory disc-shredder of the Werner Pfleiderer type. As a result the viscose will have poor filterability. It is illustrated how misleading conclusions can be drawn from investigations using continuous shredders. ***Nils Hartler and Erik Ringström.*** *Svensk Papperstidning,* v. 63, no. 19, Oct. 15, 1960, p. 641-646.

* **New Antishrink Treatment Stabilizes Gunstock Wood.** Walnut, cherry, bird's-eye maple, Oregon myrtle, Hawaiian curly mango, *Eucalyptus robusta* were successfully treated. ***Harold L. Mitchell.*** *Wood and Wood Products,* v. 65, Nov. 1960, p. 50 + 2 pages.

* **The Challenge of the Sixties for the Leather Industry.** The importance of more research in the field of the leather industry is discussed. ***Robert M. Lollar.*** *Leather Manufacturer,* v. 77, Dec. 1960, p. 51-57.

WELDING AND JOINING

Brazing With Copper in Protective Atmosphere From the Designer's Point of View. Capillary soldering and brazing are used with advantages such as material and labor saving. (*In Czech.*) Pájeni mědi v ochranné atmosféře z hlediska konstruktéra. ***O. Morávek.*** *Strojírenství,* v. 10, no. 9, Sept. 1960, p. 676-681.

Welded Cryogenic Steel Takes Impact, Pressure. Demonstration shows 9% nickel steel can take pressure and impact loading at −320 F, without stress relief after welding. Quenched and tempered plates used. *Steel,* v. 147, Nov. 7, 1960, p. 108-109.

* **Fatigue—The Problem in Relation to Welded Structures. I.** Conditions liable to give rise to fatigue failure; appearance of fatigue fractures; the principal factors in the fatigue problem. (To be continued.) ***R. P. Newman.*** *Welder,* v. 29, no. 142, Apr.-June 1960, p. 27-33.

* **Engineering and Economical Comparison of Methods of Production of Electrically Welded Tubes of Large Diameter.** The most efficient method of welding of tubes used for construction of oil and gas mains is straight-seam welding from only one plate when tubes of 529 to 720 mm in diameter are produced, and from two plates, when tubes of 820 to 1020 mm in diameter are required. (*In Russian.*) Tekhniko-ekonomicheskoe sravnenie sposobov proizvodstva elektrosvarnykh trub bol'shogo diametra. ***G. N. Iudin and A. M. Gurevich.*** *Stal',* v. 20, no. 10, Oct. 1960, p. 928-929.

* **Welding of Cast Iron and Nodular Graphite Cast Steel. I. Properties of the Heat Affected Zone of Cast Iron. II. Arc-Welding of Nodular Graphite Cast Steel.** ***Masao Homma, Tsuguyasu Wada, and Katsunobu Yamaya.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy,* v. 12, no. 5, Oct. 1960, p. 437-455.

* **Microscopic Inhomogeneity of Welding Seams.** Unbalanced crystallization of the welding bath favors the development of chemical and physical inhomogeneity. The former is connected with an uneven distribution of the alloying elements and impurities in the crystal section. The latter is due to the formation and accumulation in the crystallite of imperfections of the crystal lattice. Both have a marked effect on the technical strength of the metal of the seam during the formation of the welding bond and on the physico-chemical properties of the metal of the welding seams during service. (*In Russian.*) Mikroskopicheskaia neodnorodnost' svarnykh shvov. ***B. A. Morchan.*** *Avtomaticheskaia Svarka,* v. 13, no. 9(90), Sept. 1960, p. 24-32.

* **Electromagnetic Mixing of the Slag and of the Metallic Bath in the Electroslag Process.** A beneficial change in the shape of the metallic bath is produced, resulting in a better structure of the bars and seams. Due to improved crystallization, a decrease in the cracking tendency of the seams must be expected. Owing to the change produced by coercive mixing in the character of melting of the electrodes, the coefficient of melting can be increased to 30% or more. (*In Russian.*) Elektromagnitnoe peremeshivanie shlakovoĭ i metallicheskoĭ vanny pri elektroshlakovom protsesse. ***D. A. Dudko and I. N. Rublevskii.*** *Avtomaticheskaia Svarka,* v. 13, no. 9(90), Sept. 1960, p. 12-16.

* **Welding Aluminum. VII. Torch, Furnace and Dip Brazing.** Brazed joints, dry flux, brazing of flanged joints, clean filler metal, torch, furnace, dip brazing, use of standard air furnace, filling with molten flux, and temperature range are discussed. *Modern Metals,* v. 16, no. 10, Nov. 1960, p. 62 + 4 pages.

MISCELLANEOUS

The Case for Business Civilization. The critics of business have testified against our civilization, calling it materialistic, juvenile, and lacking in respect for pure art and fundamental science. Now the defense rises to give evidence. ***Maurice Baum.*** *Harvard Business Review,* v. 38, no. 6, Nov.-Dec. 1960, p. 56-64.

* **Properties of Solutions of a Riccati Matrix Differential Equation.** ***William T. Reid.*** *Journal of Mathematics and Mechanics,* v. 9, no. 5, Sept. 1960, p. 749-770.

* **On an Extension of Cesàro's Methods of Summability to Logarithmic Scales.** Considers special cases of Nörlund's (sometimes called Nörlund-Voronoï) methods of summability and begins by recalling basic definitions and properties of the latter. ***Izaak Wirszup.*** *Journal of Mathematics and Mechanics,* v. 9, no. 5, Sept. 1960, p. 783-812.